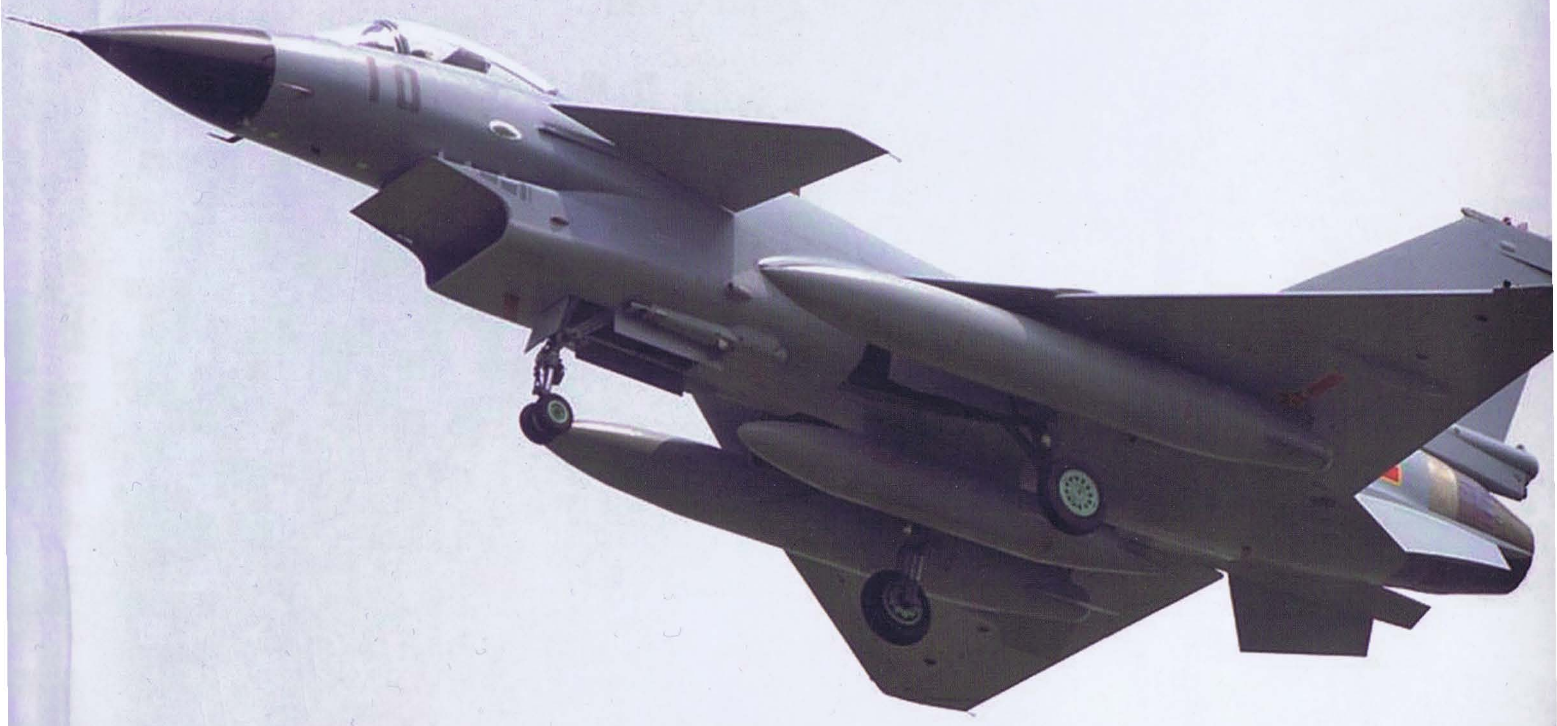


Chinese Aircraft

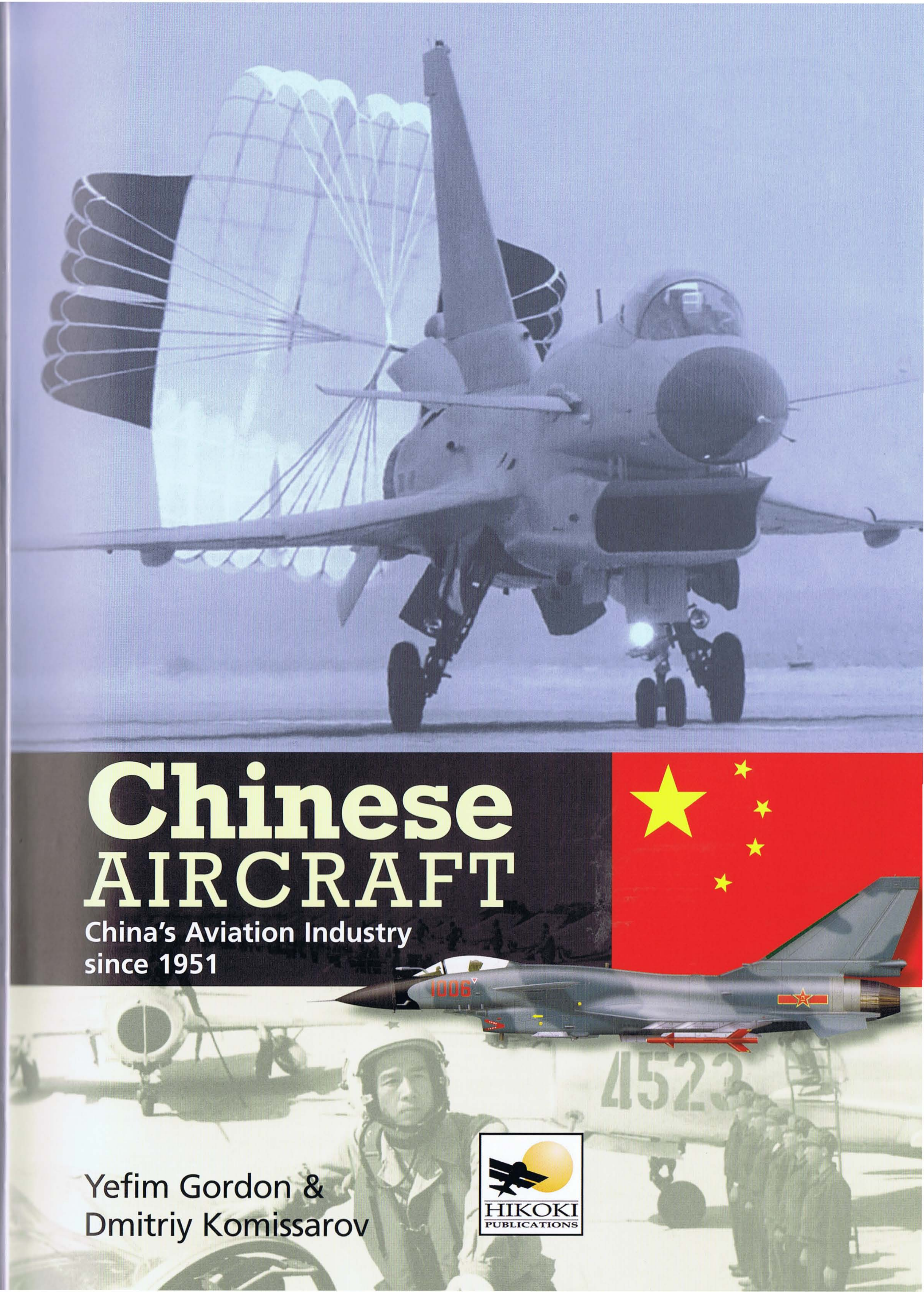
China's aviation industry since 1951

Yefim Gordon and
Dmitriy Komissarov

HIKOKI
PUBLICATIONS

Chinese AIRCRAFT

China's Aviation Industry since 1951


Chinese
AIRCRAFT
China's Aviation Industry since 1951
Yefim Gordon &
Dmitriy Komissarov
HIKOKI
PUBLICATIONS

First published in 2008 by
Hikoki Publications Ltd
1a Ringway Trading Est
Shadowmoss Rd
Manchester
M22 5LH
England

Email: enquiries@crecy.co.uk
www.crecy.co.uk

Layout by Polygon Press Ltd., Moscow

Colour profiles: © Andrey Yurgenson,
the late Sergey Yershov, Valentin Vetlitskiy
Line drawings: © Andrey Yurgenson

ISBN 9 781902 109046

Printed in Singapore

Contents

Acknowledgements

The authors would like to thank friends and photographers who kindly supplied the photos used in the making of this book: Peter Davison, Neil Lewis, Helmut Walther, Victor Drushlyakov, Lindsay Peacock, Chris Lofting.

Apart from official company advertising materials, printed sources used in the making of this book include China Today: Aviation Industry published by the Chinese Social Science Press in Beijing in 1989 and China Aircraft 1951-1997 published by Aviation Industry Press.

The book also includes information and photos by the Xinhua News Agency and from the following internet sources: www.sinodefence.com, www.top81.cn, www.chinaview.cn, www.sh.eastday.com, www.cjdby.net, www.wpcjs.com, www.af.126.com, www.defencetalk.com, www.skyscraperlife.com, www.fyjs.cn, www.top81bbs.126.com, www.ent.sino.com.cn, www.aviationnow.com.cn, www.pic.tiexue.net, www.scol.com.cn, www.stormpages.com, www.weaponeu.com, www.crienglish.com, www.defence.pk, www.pakdef.info, www.sonicmodel.com, www.sonic.bbs.com, www.jczs.sina.com.cn, www.mm.xxinfo.ha.cn, www.mil.jschina.com.cn, www.bbs.beareges.com.cn, www.military.people.com.cn, www.chinamil.com, www.concentric.net, www.mil.21dnn.com, www.mil.sohu.com, www.china.com, www.globalsecurity.org, www.avia.ru, www.aviaport.ru, www.niieap.ru.

An air-to-air of a Hongdu L15 advanced trainer prototype.

Introduction

In the first half of the 20th century the Chinese aircraft industry was non-existent. Chinese aviation was established in 1910 under the Qing Dynasty when the government set up a small air wing. Until 1949, progress was slow. True, aviation departments were set up at several universities but China's aircraft fleet consisted entirely of imported types; there were a few aircraft repair workshops (the first of these was set up in 1913) but no manufacturing facilities. This is unsurprising, considering that the country was perpetually torn apart by revolutions (the Xinhai Revolution of 1911 which ended the rule of the emperors in China, the failed anti-imperialist revolution of 1925-27) and wars. With Japanese occupation of China in 1937-45, any indigenous aircraft production was out of the question.

It was not until the last Chinese civil war of 1949 (alias the socialist revolution) and the establishment of the People's Republic of China (PRC) on 1st October 1949 that the situation began to change. It took several years to overcome the aftermath of the wars; among other things, China had to rebuild its armed forces, now known as the People's Liberation Army (PLA). In the meantime, war broke out next door in Korea in 1950, and China sided with the communist government of North Korea, extending military assistance. Apart from the tell-tale '1,000,000 Chinese volunteers', some of whom flew Soviet-supplied combat aircraft, the Chinese aircraft repair plants refurbished and repaired a total of 473 aircraft and 2,627 aero engines of various types, making a sizeable contribution to the cause of the war.

The birth of the Chinese aircraft industry dates back to 17th April 1951 when the Central Military Commission and Government Administration Council promulgated the 'Resolution on Building an Aviation Industry'. This was a bold decision, considering that China was an agrarian country at the time, with a low level of industrial development. It was decided to turn to the Soviet Union (which was interested in turning the PRC into a strong and well-armed ally) for help in setting up aircraft production.

The Bureau of Aviation Industry (BAI) was set up in 1951 as the first authority supervising aircraft production in China. In 1953, following the example of the Soviet Union, the PRC launched its first five-year economic development plan. The latter included the construction of several aircraft factories which were to produce primarily military aircraft for the People's Liberation Army Air Force (PLAAF) and the air component of the PLA Navy (PLANAF). With Soviet assistance, aircraft factories were built and commissioned in Nanchang, Shenyang (formerly Mukden), Chengdu, Harbin and Xian (formerly Chang'an). Actual production, however, did not commence until 1954, a year after the Korean War had ended.

Starting virtually from scratch, the Chinese aircraft industry appeared to be making rapid progress. The mastering of the CJ-5 primary trainer – the first aircraft to achieve quantity production in China – at Nanchang in 1954 was followed in short order by the introduction of the J-5 swept-wing subsonic jet fighter, a state-of-the-art design, at Shenyang in 1955, followed by the supersonic J-6 in 1959 and the even faster J-7 in 1961. Transport and utility aircraft production was launched at Nanchang with the Y-5 biplane in 1957, and preparations to build the Y7 twin-turboprop airliner at Xian began in 1966. Also in 1959, the Harbin Aircraft Factory began production of China's first rotary-wing aircraft, the Z5 medium helicopter. Aero engine production was also begun, the plant in Zhuzhou leading the way. As the scope of national aircraft production grew, the BAI was 'upgraded' to become the Third Ministry of Machine-Building.

However, domestic and international political developments soon had a profound influence on the Chinese aircraft industry. In May 1958, inspired by the successful fulfilment of the first five-year plan, Mao Zedong's government grew bullish and launched an ambitious plan of accelerated industrial development known as the 'Great Leap Forward'. In all areas

Chairman Mao Zedong (centre) inspects a J-6 fighter at the Shenyang plant.

Test pilot Wu Keming receives congratulations after a successful flight in a J-5.

of the economy, cranking out as much as possible within the shortest time was considered the prime target; things like quality control, fundamental research and (in the case of the aircraft industry) the laws of aerodynamics, knowledge of structural materials and even the basic design principles were brushed aside.

As a result, the industry was effectively disorganised; the indigenously built aircraft produced between 1958 and 1960 turned out to be of such inferior workmanship that the PLAAF refused to accept them and the Air Force's re-equipment plans were derailed. None of the new factories built within this time frame could be commissioned until 1962, and more than 70% of the Chinese aircraft industry's production facilities (this amounts to a shop floor area of approximately 1.02 million square metres) had to be rebuilt. Politically motivated decisions (such as the transfer of production from one factory to another, with the resulting need to move personnel and materiel) often proved damaging to aircraft production.

Besides, the Chinese military kept setting design goals that were beyond the capabilities of the national aircraft industry – even with Soviet assistance. As a result, indigenous combat aircraft projects (notably supersonic fighters) were cancelled after running into serious development problems – only to be replaced by even more ambitious ones.

Sino-Soviet relations had been deteriorating since the early 1960s, with China accusing the Soviet Union of 'revisionism' and 'moving towards imperialism'. There was also a territorial dispute between the two nations concerning some islands on the Ussuri River (which culminated in a border conflict in March 1969). As a result, Sino-Soviet relations dropped to a freezing point in 1965.

As if that weren't enough, enter the so-called Cultural Revolution – Chairman Mao's last attempt to assert himself over his more pragmatically minded comrades-in-arms who were trying to introduce elements of market economy in China and restore his position which was faltering after the failure of the 'Great Leap Forward'. Using the widespread discontent caused by this failure, Mao and his so-called Gang of Four did their best to shift the blame to the opposition inside the Communist Party of China, launching a massive attack against it. This was the birth of Maoism, a period of intensive power struggle in the nation's leadership and ideological 'cleansing' at all levels. The nationwide political debate quickly escalated into fierce confrontation between various clans and repressions against those who refused to follow the new 'party line'. The existing science and culture were declared 'bourgeois' and 'harmful', a course towards confrontation with the Soviet Union was taken, the Communist Party was effectively decapitated, the nation was totally militarised and found itself in almost complete political isolation.

This period lasted from 1966 to Mao's death in 1976, leading to untold chaos and devastation in the national economy and the country's life as a whole. Above all, it caused a large loss of life – an estimated 1 million people were killed in the course of the 'Cultural Revolution'. The resulting shortage of specialists was a further blow to the aircraft industry.

As a result, China's aircraft industry was forced to go it alone. Gradually the industry developed from reproduction of existing aircraft types to development of indigenous versions and aircraft of entirely indigenous design. Subsequently the Third Ministry of Machine-Building was transformed into the Ministry of Aviation Industry and, later still, the Ministry of Aerospace Industry when China started manufacturing and launching space vehicles.

Sino-Soviet relations remained strained even after the end of the 'Cultural Revolution' – they did not improve until the mid-1980s. Hence, acting in accordance with the principle 'my enemy's enemy is my friend', the People's Republic of China established diplomatic and economic relations with the western world. (Until then, since 1949 China had been represented on the international arena solely by the Republic of China (RoC) – that is, the breakaway Taiwan.) As a result, the PRC was now able to import US and West European aircraft and gain limited access to western aircraft technologies, including aero engines. There were several implications of this; for one thing, China again resorted to licence production or reverse-engineering – this time of western aircraft (specifically, French helicopters and the McDonnell Douglas MD-82/83 airliner). For another, new Chinese civil aircraft were now developed with US Federal Airworthiness Regulations (FAR) in mind (later the domestic civil aircraft airworthiness regulations were harmonised with FAR). Also, more often than not they were built around western engines, which improved their export potential – in theory at least.

In 1993 the Chinese aircraft industry underwent further reforms. The Ministry of Aerospace Industry was disbanded, giving place to the Aviation Industries of China (AVIC) state-owned corporation established on 26th June 1993 to develop the market economy and expand international collaboration in aviation programmes. AVIC, which was headquartered in Beijing, exercised control over all national aircraft, aero engine and component manufacturing plants. The CATIC Group (China National Aero-Technology Import and Export Corporation, or *Zhongguo Hangkong Jishu Jinchukou Zonggongsi*) was formed on 26th August 1993, with CATIC (founded in January 1979) as its core company, to be responsible for import and export of aero and non-aero products, subcontract work and joint ventures.

In line with the new policy concerning the national aerospace industry, Chinese aircraft factories forming part of AVIC now manufactured airframe components for western aircraft – the Boeing 747 long-haul airliner, the Airbus Industrie A300 and Boeing 757 medium-haul airliners, the Airbus Industrie A318/A320 and Boeing 737 short/medium-haul airliners, the ATR72 and Bombardier Dash 8Q regional turboprops and the Bombardier 415 fire-fighting aircraft.

The Chinese aerospace industry suffered from the Asian slump of 1998. That year the total workforce of the industry was reduced to about 500,000, when about 34,000 workers were laid off and some 14,000 others transferred to non-aerospace activities.

On 1st July 1999, in an effort to become more competitive, China established ten new state-owned aviation corporations. Thus the AVIC behemoth, which then had 560,000 employees, was divided into two 'competing but co-operating' entities – AVIC I and AVIC II. They are equal economic entities authorised by the state to make investments, operating as state holding companies under the direct

An aerial view of the Shenyang Aero Engine Factory.

supervision of the Central Government. The two groups have a similar scope of business (aircraft, aero engines, avionics and equipment, plus non-aviation products such as automobiles) but have a different specialisation. AVIC I focuses on large and medium-sized aircraft while AVIC II gives priority to feeder aircraft and helicopters.

In June 2008, however, it was announced that AVIC I and AVIC II are to re-merge. According to the merger commission formed at AVIC I, the united company will be formally incorporated in July. No further details of the forthcoming merger have been released so far.

***

A few words have to be said about the Chinese aircraft designation system. The original system used by the manufacturers consisted of a fancy-sounding and sometimes ideologically flavoured codename in typical Chinese style – *DongFeng* (East Wind) for fighters, *FeiLong* (Flying Dragon) for bombers, *XionYing* (Mighty Eagle) for attack aircraft, *HongZhuan* (Red Craftsman) for trainers – and a three-digit number. The first digit was again a code for the aircraft class (1 = fighter, 2 = bomber, 3 = attack aircraft, 5 = trainer; 4 possibly denoted transport aircraft) and the other two ran consecutively (for example, Dongfeng-101 through Dongfeng-113). The military, however, used two-digit service designations matching the last two of the year when the type was accepted for service, with an occasional version designator letter added; thus, the Dongfeng-102/-103/-105 family that completed tests in 1959 became the Type 59, Type 59A and Type 59B respectively.

In 1964 China switched to a new system used by the manufacturers and the PLAAF/PLANAF alike which designated the aircraft by role. The Chinese word(s) denoting this role were usually abbreviated to a one- or two-letter prefix followed by a sequential number within each class of aircraft: BA (target drone), CJ (*Chuji Jiaolianji* – primary trainer), H (*Hongzhaji* – bomber), J (*Jianjiji* – fighter), JH (*Jianjiji Hongzhaji* – fighter-bomber), JL (*Jiaolianji* – [advanced] trainer), Q (*Qiangjiji* – attack aircraft), SH (*Shuishangji Hongzhaji* – maritime bomber, ie, flying boat), WZ (*Wuren Zhenchaji* – unmanned reconnaissance aerial vehicle), X (*Xiangji* – glider), Y (*Yunshuji* – transport), Z (*Zhishengji* – 'vertically ascending vehicle', ie, helicopter or VTOL aircraft). A curious aspect of this system was that the numeric designator was, with very few exceptions, not lower than 5; this was reportedly due to superstitious reasons, as the Chinese numeral 'four' sounds very similar to the Chinese word for 'death'.

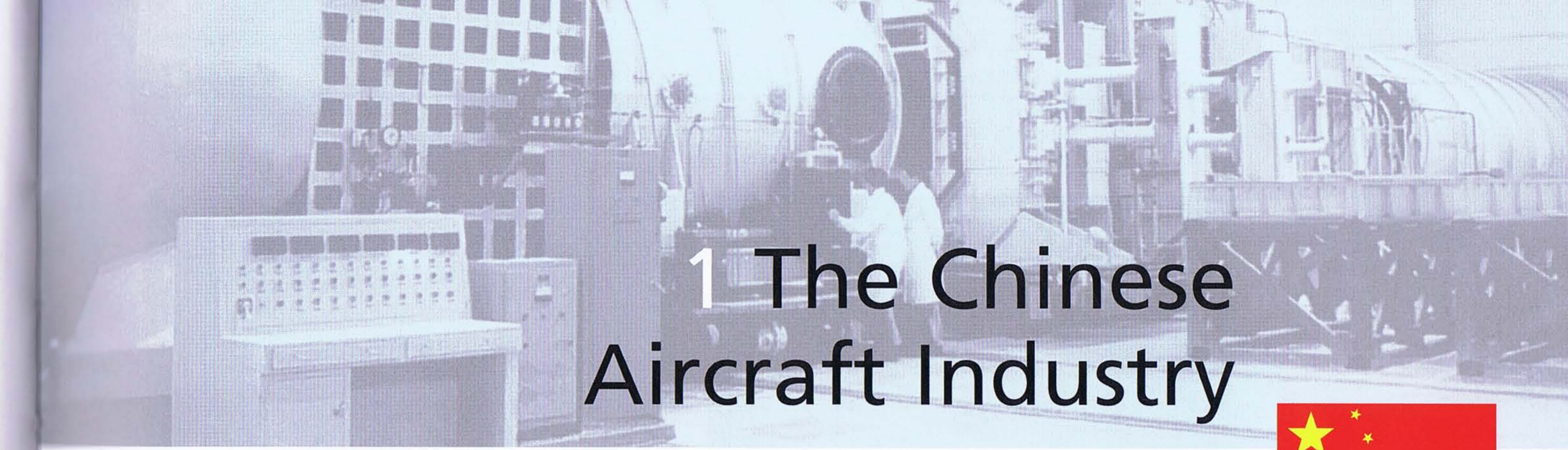
As the basic design was refined and modified in China, the consecutive versions were identified by Roman numerals; thus, the J-7 fighter was followed by the J-7 I, J-7 II, J-7 III and J-7 IV. After 1987 the Roman numerals were replaced by Roman letters; thus the H-6 IV became the H-6D, though this is not a hard and fast rule – in some cases the letters did not match the former numerals, denoting a different version. Export aircraft wore further 'westernised' designations – for instance, the Q-5 III became the A-5C.

In the case of specialised versions an extra designator letter was used: for example, D for *Dian* (electronic warfare – either electronic intelligence or electronic countermeasures), J for *Jiaolianji* (trainer), U for *You* (in-flight refuelling tanker) and Z for *Zhenchaji* (reconnaissance). Normally it was added to the prefix (for example, HD, HJ, HU and HZ denoted ECM, conversion trainer, IFR tanker and photo reconnaissance versions of bombers), but again this was not a hard and fast rule. For example, an armed version of the Z9 helicopter was designated Z9W (*Wuzhuang* – armament) rather than ZW-9, and a maritime patrol version of the Y8 transport was designated Y8X (*Xun*).

***

Considering that China has been largely closed to the outside world for many years and that its armed forces and defence industry (including the aircraft industry) have been under tight security wraps, reliable information on Chinese aircraft – especially new designs – has been hard to come by. The situation began to improve when the Internet found its way to China. Covertly taken photos of current Chinese aircraft (including experimental ones) and details of aircraft programmes were published on the worldwide web via Hong Kong and Taiwan. (The latter aspect is unsurprising, since in the PRC Internet activities are closely controlled by the state authorities; this has been referred to as 'the Great Firewall of China'.) Hence in many cases the authors have had to rely on literature and the Internet as the only available sources of information.

It has to be said that aircraft engines, weapons and equipment are not dealt with in this book for reasons of space. They will be dealt with in a future expanded edition.



1 The Chinese Aircraft Industry

The principal factories and institutions of the Chinese aircraft industry are listed in this chapter.

The manufacturers

As of this writing, the manufacturing element of the Chinese aircraft industry is primarily represented by the two state-owned corporations, Aviation Industries of China I (AVIC I) and Aviation Industries of China II (AVIC II).

AVIC I

AVIC I is headquartered in Beijing and headed by President Liu Gaozhuo, with Yang Yuzhong and Gu Huizhong as Senior Vice-Presidents. The corporation mainly engages in the development, manufacturing, sales, and after-sales services of military and civil aircraft, engines, airborne equipment, and weapons systems. Military products include fighters, fighter-bombers, bombers, transports, trainers and reconnaissance aircraft. Civil aircraft include short/medium-haul airliners and transport aircraft. It also produces more than 3,000 different types of non-aerospace products in 8 major categories, including industrial gas turbines, automobiles, motorcycles, refrigerating machinery and environmental protection equipment. AVIC I services include aircraft leasing, general aviation services, and management of national aircraft verification and flight testing.

AVIC I comprises 53 large and medium-sized industrial enterprises, 31 research institutes, 19 specialised companies and institutions engaged in foreign trade, material supply, research and development. Nearly 240,000 people are employed in industrial enterprises while 45,000 more employees

Production of H-6 bombers and Y7 airliners at the Xian aircraft factory.

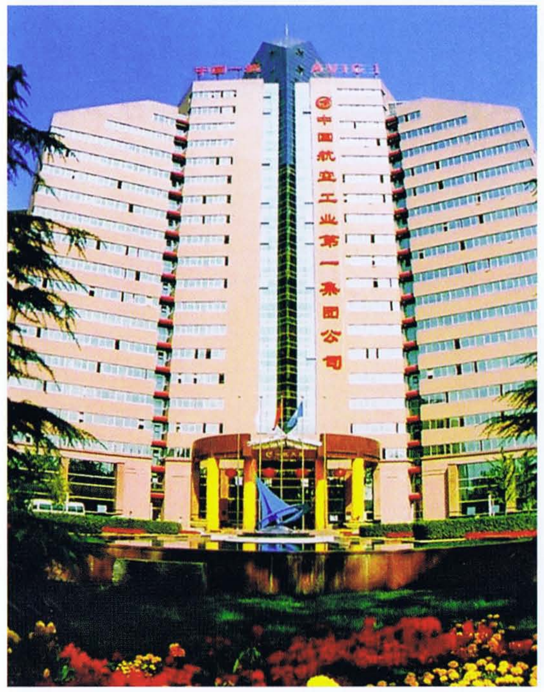
Liu Gaozhuo, President of the AVIC I corporation.

work in research institutes. Total assets are 34.9 billion yuan.

Examples of AVIC I enterprises include Chengdu Aircraft Company, Xian Aircraft Company, Shenyang Aircraft Company and their National Trade Bureau. Parts for Boeing jetliners and other non-Chinese aircraft are made at these facilities. Flight testing of civil and military aircraft are also under the responsibility of AVIC I.

The principal AVIC I aviation entities are:

- AVIC I Commercial Aircraft Co. (ACAC)
- Chengdu Aircraft Design Institute (CADI)
- Chengdu Aircraft Industry Group (aka Chengdu Aircraft Corporation – CAC)
- China Air-to-Air Missile Research Institute
- China Flight Test Establishment (CFTE)
- China Gas Turbine Establishment
- Guizhou Aviation Industries Group Co. (GAIGC)
- Shanghai Aero-Engine Manufacturing Plant
- Shanghai Aircraft Manufacturing Factory (SAMF)
- Shanghai Aircraft Research Institute (SARI)
- Shenyang Aero-Engine Research Institute
- Shenyang Aircraft Industries Group (aka Shenyang Aircraft Corporation – SAC)
- Shenyang Liming Engine Manufacturing Corporation
- Xian Aero-Engine Corporation
- Xian Aircraft Design and Research Institute (XADRI)
- Xian Aircraft Industries Group (aka Xian Aircraft Company – XAC)



The AVIC I headquarters in Beijing.

AVIC I Commercial Aircraft Company

The AVIC I Commercial Aircraft Company (ACAC) was established in 1998 by six organisations – CAC, SARI, SAIC, SAC, XADRI and XAC. The company developed and manufactured the ARJ21 family of regional jets (now the responsibility of CACC – see below).

ACAC is based in Shanghai. Yang Yuzhong is Chairman of the Board of Directors, Zheng Qiang is President, and Tao Zhihai and Chen Jin are vice-presidents.

Chengdu Aircraft Design Institute

Situated in Chengdu (Sichuan Province), the Chengdu Aircraft Design Institute was established in 1970 on the basis of the 13th Aviation School. This organisation started life as the Chengdu branch office of the No. 601 Design Institute in Shenyang, but presently became a research and development institution in its own right – the No. 611 Design Institute. It specialises in fighter design, having developed such aircraft as the J-7 third-generation fighter family and the J-10 fourth-generation fighter (see Chapter 2).

The institute covers more than 80 disciplines, including fluid dynamics, engineering, structural strength, vibration research, electronics design (including radars and laser systems), flight vehicle design, electricity, instrument design, vacuum research, automatic control systems, environmental control systems, material application, computer and software development, reliability research, and information processing.

Female workers at AVIC check the quality of an engine component.

Baggage doors for a western airliner manufactured by an AVIC I enterprise.

Chengdu Aircraft Industry Group

The Chengdu Aircraft Industry Group (Chengdu Aircraft Corporation – CAC, or *Chengdu Feiji Gongye Gongsi*) specialises in building fighters. It is headquartered in Chengdu; Luo Ronghuai is Chairman and President.

CAC was established in 1958 as the Chengdu State Aircraft Factory No. 132 and built with Soviet assistance. Over the years, it has produced various types, starting with the J-5A second-generation interceptor (1964-69) and its JJ-5 (FT-5) trainer derivative (March 1965 – late 1986). These were followed by the J-7 third-generation fighter family – the basic J-7 (F-7A), which entered production in June 1967; the J-7 I; the J-7 II (F-7B) from 1979; the export F-7M (1985-89?) and F-7P (1989-93); the J-7 III (J-7C) in 1992-96; the J-7 IV (J-7D) in 1994-99; the J-7E (1993-2002); the F-7PG (2001-02); the J-7G and its F-7BG and F-7NM export derivatives (from 2002). Currently the plant produces the J-10 fourth-generation medium fighter (since 2002) and the FC-1 (JF-17) light fighter that is produced in co-operation with Pakistan since 2008

CAC is also an aircraft parts manufacturer. Subcontract work includes passenger doors for the Airbus Industrie A320 short/medium-haul airliner; wing parts for the Boeing 737 short/medium-haul airliner and Boeing 747 long-haul airliner; the rear fuselage (Section 48) and tail surfaces for the Boeing 757 medium-haul airliner; and fuselage components for Dassault Falcon 2000EX business jet. It is also due to manufacture the rudder for the Boeing 787 Dreamliner medium/long-haul airliner. Additionally, it will build the flightdeck section of the indigenous ARJ21 regional jet.

China Air-to-Air Missile Research Institute

Based at Luoyang, Henan Province, and originally known as the No. 607 Institute, the Air-to-Air Missile Research Institute (AAMRI) is tasked with developing fighter weapons. In particular, this organisation developed the PL-4, PL-10 and PL-11 semi-active radar-homing medium-range AAMs, which proved unsuccessful. Not to be put off, AAMRI brought out the PL-12 (PiLi-12) active radar-homing 'beyond-visual-range' AAM, also known as ShanDian-10 (SD-10) for export. Development of this weapon officially began in 1997 and took seven years to complete. During a live test in August 2005, a total of eleven missiles were fired, all hitting their targets.

China Flight Test Establishment

The China Flight Test Establishment (CFTE) is an R&D organisation responsible for testing and evaluating all civil and military aircraft in China during the development and certification phases. In addition, the organisation also carries out flight tests and analysis in support

The building of the Chengdu Air craft Design Institute.

The CFTE management building; note the AVIC I logo on top

of aircraft programmes. While some of the aircraft operated by CFTE are merely prototypes, heavily modified testbeds and research aircraft of all sorts make up a considerable part of the fleet.

The CFTE's main base is at Yanliang, Shaanxi Province, a small industrial town approximately 56 km (34.7 miles) northeast of Xi'an. A second facility is located at the PLAAF's Dinxing airbase in the Gobi Desert in Gansu Province.

The organisation's aircraft are operated by a special PLAAF unit – the Air Force Flight Test Regiment (AFFTR). This unit was officially activated on 7th March 1974, but it can trace its origins back to the flight test team of the 8th Research Institute of the PRC 1st Ministry of Machinery Industry.

The CFTE flight line at Yanliang crowded with test and development aircraft.

An overall view of Yanliang airfield, with six Chengdu J-10 prototypes in the foreground.

Guizhou Aviation Industries Group Co.

The Guizhou Aviation Industries Group (*Guizhou Hangkong Gongye Gongsi*) is based in Guiyang, Guizhou (formerly Kwangtung) Province. It is currently headed by President Zhang Jun, with Zhang Shangdao as Vice-President and Zhou Wancheng as Chairman of the Board.

GAIGC incorporates many enterprises, factories and institutes engaged in various aerospace and non-aerospace activities; as of 2004, total assets were 10.6 billion yuan and the aerospace workforce was about 6,000. Main aircraft manufacturing plants are named Honghu, Honglin, Longyan, Shuangyang and Yunma.

Over the years, the main enterprise of GAIGC produced the J-6 IV interceptor (1970) and various versions of the JJ-7/FT-7 trainer (starting in February 1986); it also manufactured J-7 components for Chengdu. Current programmes include the JL-9 (FTC-2000) advanced trainer and the WZ-2000 unmanned reconnaissance aerial vehicle. The group also produces air-to-air missiles and rocket launchers (at the Fenglei Armament Factory), as well as maintenance jigs and tools for the Airbus airliner family.

Liyang Motor Corp.

Located at Guizhou and initially known as the Guizhou Engine Factory (GEF), the plant was founded in early 1965, later becoming part of the Guizhou Aviation Industries Group. It mastered production of the WP-7 afterburning turbojet in 1969, followed by the WP-13 afterburning turbojets.

Shanghai Aircraft Manufacturing Factory

The Shanghai Aviation Industries Group (SAIG, or *Shanghai Hangkong Gongye Gongsi*) chaired by Shen Huancheng includes more

A small wind tunnel at one of AVIC I's research and development establishments.

than 20 enterprises, of which the principal ones are the Shanghai Aircraft Manufacturing Factory (SAMF), the Shanghai Aircraft Research Institute (SARI), the Shanghai Aero-Engine Manufacturing Factory; and Shanghai International Aero Technology.

Of these, SAMF (*Shanghai Feiji Zhizao Gongchang*) is the oldest, having been established in 1950. Unfortunately little is known about its activities. In the early 1980s the factory built the prototype and the static test example of the Y10 medium-haul airliner – China's first passenger jet; yet series production failed to materialise. In 1987-91 SAMF undertook assembly of 35 McDonnell Douglas MD-82/MD-83 airliners from US-supplied kits, followed by two MD-90s in 2000.

In 1979 SAMF became the first Chinese company to start subcontract work for western manufacturers. In particular, it was the sole supplier of MD-80 horizontal stabilisers, mainwheel well doors and some other parts. Currently it manufactures Boeing 737NG (737-600/-700/-800/-900) horizontal stabilisers. In April 2008 SAMF became a subcontractor for Airbus Industrie, delivering its first set of cargo door frames for the Airbus A320 family. Currently the plant is to undertake final assembly of the ARJ21 regional jet.

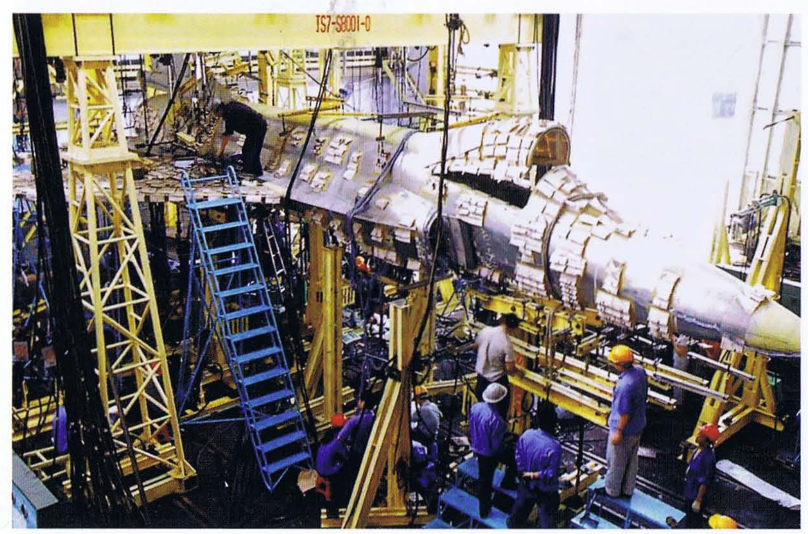
Shanghai Aircraft Research Institute

This R&D institution was responsible for the development of the Y10 airliner. It also participated in the development of the ARJ21 regional jet.

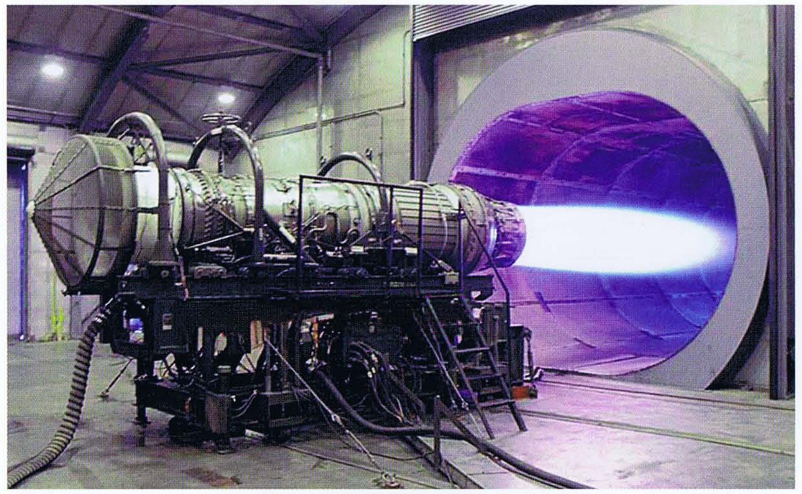
Shenyang Aircraft Corporation

Based at Shenyang (formerly Mukden) in Liaoning Province, Manchuria, the Shenyang Aircraft Corporation (SAC, or *Shenyang Feiji Gongsi*) is the oldest Chinese aircraft industry enterprise and the cradle of Chinese fighter design and production. It is currently presided by Li Fangyong.

The Shenyang aircraft factory was founded on 29th June 1951 with Soviet assistance. Its first products were the JJ-2 jet fighter trainer and the J-5 second-generation jet fighter (the latter was in production in 1955-69). In 1959 the factory launched trial production of the J-6A supersonic all-weather interceptor and J-6 day fighter; this was followed by full-scale production of the J-6 from 1963 onwards and other versions – the JZ-6 reconnaissance aircraft (1967), the improved J-6C day fighter (starting in August 1969), the J-6 I, J-6 II, J-6 III and finally the JJ-6 (FT-6) conversion trainer produced in 1973-1986.



A Chengdu FC-1 Xiaolong, aka JF-17 Thunder (c/n 02), undergoes static tests.



A WS-10A Taihang turbofan is bench-run at SARI.

The logo of the Xian Aircraft Company.

The logo of the Xian Aero Engine Corporation.

Initial production of the J-7 third-generation fighter took place in 1966 but was transferred to the Chengdu plant once the latter had been commissioned. In 1979 the Shenyang aircraft factory began production of the J-8 interceptor; this was followed by the improved J-8 I in 1985-87 and the drastically redesigned J-8 II and its derivatives from 1988 onwards. On 29th June 1994, SAC became the core enterprise of the newly formed Shenyang Aircraft Industries Group.

Production of the J-11 fourth-generation fighter (licence-built Sukhoi Su-27SK) began in 1998. Currently the plant is mastering production of indigenous derivatives – the single-seat J-11B and the two-seat J-11BS.

On the commercial aviation side, SAC is a subcontractor for the indigenous ACAC (now CACC) ARJ21 regional jet, supplying the tail unit, engine pylons and electrical subassemblies. Also, since 1985 SAC has been doing subcontract work for western aircraft manufacturers. This includes doors for the Bombardier Dash 8 regional turboprop, cargo doors for the Boeing 757, wing ribs and emergency exits for the Airbus A310 and A320, the tailcone and landing gear doors for the Lockheed Martin C-130 Hercules transport, rear fuselage and tail components for the Boeing 737-700, floors and bulkheads for the Boeing 747and so on; the latest is the manufacture of the fin leading edge for the Boeing 787.

In November 2007 the US general aviation aircraft manufacturer Cessna Aircraft Company announced it had selected SAC as a partner to manufacture the new Model 162 SkyCatcher light sport aircraft.

Currently the Shenyang Aircraft Industries Group has a workforce of about 30,000; only some 30% of the current activities are in aerospace.

Shenyang Aero-Engine Research Institute

Originally known as the Shenyang Aero-Engine Design Office (SADO) and then as the No. 606 Design Institute, the Shenyang Aero-Engine Research Institute (SARI) was responsible for military engine design. It developed such engines as the PF-1 non-afterburning turbojet for the indigenous JJ-1 trainer, the Hongqi-2 afterburning turbojet intended for the stillborn Dongfeng-107 fighter. Other SARI products were the WP-7A (1969), WP-13 (1978) and WP-14 Kunlun afterburning turbojets and the experimental WS-5 (co-developed with the China Aeronautical Establishment in 1963-73) and WS-6/WS-6A turbofans. The latter model had a long development cycle lasting from 1964 to 1981.

Shenyang Liming Motor Co.

This enterprise was created on the basis of the Shenyang Engine Overhaul Factory in 1954-57, emerging as the Shenyang Engine Factory (SEF). Under the guidance of its first director Mo Wenxiang and chief engineer Xu Xizan the plant launched production of the WP-5 afterburning turbojet with Soviet assistance in 1956 while still under construction. This was followed by the WP-5A/WP-5D, WP-5B and WP-5C non-afterburning versions in 1965, 1966 and 1976 respectively.

The administration buildings of the Xian Aero Engine Corporation.

The WP-6 afterburning turbojet entered trial production in 1959 but quality problems forced an interruption until late 1960. Production of the WP-7 afterburning turbojet began in 1963 but had to be transferred to Guizhou because SEF was overburdened with other work.

In 1976 the plant commenced trial production of the WS-9 afterburning turbofan, which turned out to be difficult to master and took a long time to debug. In November 2006 the Liming Motor Co. completed the development and test cycle of the WS-10 Taihang afterburning turbofan intended for the J-10 and J-11 fourth-generation fighters.

Xian Aircraft Industry Company

As the name implies, the Xian Aircraft Industry Company (XAC, or *Xian Feiji Gongye Gongsi*) is located in Xian, Shaanxi Province. Gao Dacheng is the company chairman and president, assisted by vice-chairman Meng Xiangkai and vice-president Chen Fusheng. Aviation activities embrace 20 aircraft design departments and five aircraft design laboratories, and have produced more than 20 different types of aircraft.

The large aircraft factory at Xian was established in 1958; yet production of the H-6 medium bomber in Xian did not commence until 1964. Specialised versions of the bomber were gradually introduced (the nuclear-capable H-6A followed in 1966, the H-6D missile carrier in 1983 etc.) Production stopped in the early 1990s – only to resume at the turn of the century when the up-armed H-6H and the re-engined H-6K were developed.

In 1982 the plant began production of the Y7 regional airliner family. This line of development is still current – the Y7-100 entered production in 1986, followed by the Y7-200A in 1999 and the MA60 in 2000; the latest passenger version called MA600 is due to enter tests as of this writing. The Y7H freighter version equipped with a rear loading ramp was introduced in 1988.

Another major current programme is the JH-7 fighter-bomber which entered initial production around 1990.

In 1980 XAC established itself as a subcontractor for western aircraft manufacturers. Boeing was the first customer; the plant manufactures fins and tailplanes for the Boeing 737 and Boeing 747; wing trailing-edge ribs for the 747 and floor beams for the 747-400 Special Freighter. XAC also produces A320 wing components and doors for Airbus

MA60 fuselage side panels being assembled at Xian.

Industrie and water tanks, stabilising float pylons, ailerons and various doors for the Bombardier 415 waterbomber. Component manufacture for the ATR42/ATR 72 regional turboprop began with wingtips in 1986 but was extended in May 1997 to include ATR 42 wing boxes and ATR 72 rear fuselage sections.

Xian Aero-Engine Corporation

Originally known as the Xian Engine Factory (XEF), this plant began production of the WP-8 non-afterburning turbojet in 1965. It also built the WDZ-1 auxiliary power unit.

Xian Aircraft Design & Research Institute

The Xian Aircraft Design & Research Institute (XADRI), initially known as the No. 602 Aircraft Design Institute, is an R&D establishment tasked mainly with developing combat aircraft (in particular, the JH-7 fighter-bomber). It also had a hand in developing the ARJ21 regional airliner.

Aircraft engineering centre

AVIC I also holds a small share (5%) in an aircraft engineering centre which the European consortium Airbus Industrie has set up with AVIC II.

AVIC II

The logo of the AVIC II corporation.

By comparison, AVIC II – likewise headquartered in Beijing – comprises 81 subordinate industrial enterprises, research institutes and other organisations. It is currently headed by President Zhang Hongbiao, with Song Jingang, Xu Zhanbin and Liang Zhenhe as vice-presidents.

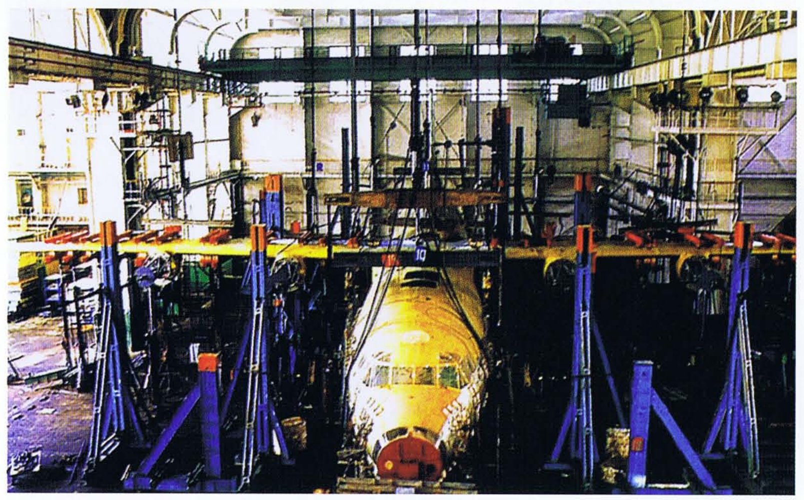
Zhang Hongbiao, President of the AVIC II corporation.

AVIC II has five divisions, respectively specialising in the production of fixed-wing aircraft (trainers, strike aircraft, regional airliners and heavy transports), helicopters, aero engines, airborne equipment; and civil aircraft market development. Its registered capital is 12.6 billion yuan and total assets are 78 billion yuan.

AVIC II was stated in mid-2002 to have government approval to float its non-military business on the Hong Kong Stock Exchange. To this end, a new company called AviChina Industry and Technology was created in 2003. That same year, AVIC II signed a memorandum of understanding with Antonov, to pursue the possibility of producing An-70 and An-124-300 in China. An MoU was signed with Eurocopter in 2004 for joint development of a new 7,000 kg (15,4321b) class helicopter (EC 175, provisional designation Z-12) as a replacement for Sikorsky S-70C-2 Black Hawk.

The principal aviation entities of AVIC II are:

- Baoding Propeller Factory
- Changhe Aircraft Industry Group (CHAIG)
- Changzhou Aero-Engine Factory
- Chengdu Engine Company (CEC)
- Chinese Helicopter Research and Development Institute (CHRDI)
- Dongan Engine Company (WJ5)
- Harbin Aircraft Industries Group
- Hongdu Aviation Industry Group (HAIG)
- Shaanxi Aircraft Industry Group (SAC)
- Shijiazhuang Aircraft Industry Corporation (SAIC)
- South Aero-Engine Company
- Zhuzhou Aviation Power Plant Research Institute



Static tests of a Shaanxi Y8 transport.

Baoding propeller factory

Located in Baoding, Hebei Province, this plant mainly specialises in propellers for fixed-wing aircraft. Its products have included the J9-G1 two-blade variable-pitch propeller (used on the CJ-6 trainer), the J12-G15 four-blade variable-pitch propeller (used on the Y-5 transport), the J16-G10A four-blade reversible-pitch propeller (used in 1984 on the Y7 airliner, Y7H transport and SH-5 flying boat), the J17-G13 four-blade reversible-pitch propeller (used on most versions of the Y8 transport) and the JL-4 six-blade reversible-pitch propeller intended for the Y9 advanced transport. However, Baoding also manufactures main rotor blades for the Z9 helicopter.

Changhe Aircraft Industries Group

The Changhe Aircraft Industries Group (*Changhe Feiji Gongye Gongsi*) is China's principal helicopter manufacturer. It is based in Jingdezhen, Jiangxi Province. Wang Bin is the company president.

The company was founded in 1969 and is now one of the 500 largest industries in China, with a 2004 workforce of more than 11,000. It produced the Z8 medium helicopter (from 1986); currently it manufactures the Z11 light helicopter (since 1997) and is set to produce the WZ10 attack helicopter.

CHAIG has been subcontracted to manufacture the tailcone, tail rotor pylon and horizontal stabiliser of the Sikorsky S-92 helicopter. The tail for the first S-92 was delivered to Sikorsky in May 1997; components for the S-76++ were also produced. The company has also become formed a joint venture with AgustaWestland known as Jiangxi Changhe Helicopter Company to assemble and market the AgustaWestland A 109E Power as the CA 109; the venture is owned 60% by CHAIG and 40% by AgustaWestland.

In 2007 it was announced that CHAIG would probably be co-developing a new helicopter with Sikorsky Aircraft.

Changzhou Aero Engine Company

Also known as the Jiangxi Helicopter Engine Factory, this plant located in Changzhou, Jiangxi Province, was established in 1969 with assistance from the Harbin engine factory and specialises in turboshaft engines. In particular, producing the WZ6 turboshaft from 1975 onwards.

Chengdu Engine Company

Construction of the Chengdu Engine Factory (CEF) started in October 1958 with assistance from the colleagues at Shenyang. Starting off with trial production of the RD-500K turbojet intended for a cruise missile, CEF soon switched to the WP-6 afterburning turbojet which entered trial production in 1962. The uprated WP-6A was developed in 1984 under the direction of Gao Ge, followed by the WP-6B in 1970. Subsequently the Chengdu Engine Company manufactured components for the WP7 and WP13 afterburning turbojets (the latter type was co-produced with the Guizhou plant). It also developed the WS-8 experimental commercial turbofan in 1970-73.

Chinese Helicopter Research & Development Institute

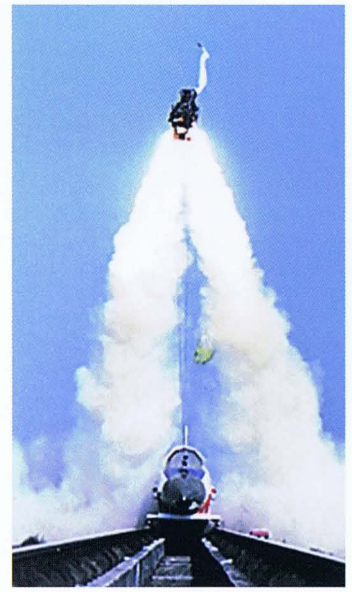
The Chinese Helicopter Research and Development Institute (*Zhongguo Zhishengji Sheji Yangjiuso*) is located in Jingdezhen, Jiangxi Province. It is currently headed by Chief Designer Wu Ximing.

CHRDI has been actively involved in indigenous helicopter design since the 1970s. It was responsible for the Z7 medium-lift helicopter, which failed to reach the flight test phase for reasons unrelated to the design; it has also developed the WZ10 attack helicopter and is working on the closely related Z10 transport/utility helicopter.

Harbin Aircraft Industries Group

The Harbin Aircraft Industries Group (*Harbin Feiji Gongye Gongsi*) is headquartered in Harbin, Heilongjiang Province. Its President and General Manager is Cui Xuewen, with Xu Zhanbin as Vice-President.

HAIG is a manufacturer of both fixed-wing and rotary-wing aircraft, as well as of non-aerospace products, including automobiles. It acts as the parent organisation of the Hafei Aviation Industry Company (*Hafei Hangkong Gongye Gongsi*); the latter is led by President Cui Xuewen, who is assisted by Qu Jingwen as General Manager and Wang Bin as Chairman of the Board. The group's 1998 workforce (the latest figure provided) was approximately 18,000.



The Chinese industry also manufactures various aircraft systems and equipment. Here a TY-6 ejection seat is test-fired from a J-10 cockpit mock-up.

The Hafei Aviation Industry Company started life as the Harbin Aircraft Factory in 1952. A major reconstruction, in the course of which the shop floor area was doubled, began in 1958; subsequently the plant was known as Harbin Aircraft Manufacturing Corporation (HAMC, or *Harbin Feiji Zhizao Gongsi*). The first fixed-wing design produced there was the H-6 medium bomber (in 1959) but production was immediately transferred to Xian. Later, the plant concentrated on the H-5 (B-5) light bomber and its HJ-5 (BT-5) trainer version, starting in April 1967; a small batch of SH-5 flying boats was built in 1970-1984. On the commercial side, in April 1977 HAMC began manufacturing the Y11 piston-engined utility aircraft. This was followed by the Y12 turboprop family, with various versions appearing from 1983 onwards; the Y12 IV and Y12E are the current versions.

The logo of the Harbin Aircraft Industries Group.

The Hafei company also acts as a subcontractor for Boeing, with which it signed an agreement in June 2004 to produce metallic and composite parts for various airliners, including the wing/fuselage fairing for the Boeing 787.

Rotary-wing aircraft produced at Harbin were the Z5 medium helicopter (1959-60 and 1963-79) and the Z9 medium helicopter family built under French licence from 1981 onwards. The Hafei Aviation Industry Company teamed up with Eurocopter and Singapore Technologies Aerospace to co-produce the Eurocopter EC 120 Colibri, the three

participants holding 24%, 61% and 15% of the stock respectively. Originally Hafei built the cabin module; on 20th November 2003 an additional agreement was signed, allowing the company to begin full local assembly of this helicopter for the home market as the HC 120. The official contract was signed in Paris on 11th June 2004, and the first Hafei-assembled EC 120 was completed at the end of the year.

The Hafei company also performs subcontract work for Bell Helicopter Textron, manufacturing the cabin module, tailboom and other components for the Bell 430 since September 2005, and for Eurocopter.

In December 2002 HAIG created a new subsidiary as a joint venture with Embraer (Harbin Embraer Aircraft Industry Co Ltd) to co-produce the ERJ-145 regional jet. Embraer holds a 51% stake, HAIG and HAI having 24.5% each.

Dong'an Engine Manufacturing Co.

Originally known as the Harbin Engine Factory (HEF), this former weapons factory (converted to an engine plant in 1951) mastered production of the HS-7 and HS-8 14-cylinder radial engines in 1958 and 1962 respectively under the direction of Wang Xiurui and Xue Weihua. The WJ-5A turboprop entered trial production at Harbin in 1970, and the uprated WJ-5A-1 followed from 1982 onwards.

In addition, HEF also undertook production of helicopter transmission systems – specifically, the P-5 main gearbox for the Z5 helicopter, the drive train for the experimental Z6 and for the production Z8.

Hongdu Aviation Industries Group

The Hongdu Aviation Industries Group (Hongdu Hangkong Gongye Gongsi) based in Nanchang, Jiangxi Province, is the parent organisation of the former Nanchang Aircraft Manufacturing Company (NAMC). It is presided by Jiang Liang; the civil aircraft division is headed by Huang Xuejun.

The Nanchang factory (originally State aircraft factory No. 320) was reorganised from an aircraft repair facility. It started out by producing the CJ-5 primary trainer in 1954-58; later, it built several variants of the Y-5 utility biplane in 1957-68 before transferring production of the type to Shijiazhuang. A small number of J-6A and J-6B interceptors was produced in 1961-63. The CJ-6 trainer entered production in 1962 and was still in production in 2005.

The logo of the Hongdu Aviation Industries Group.

In 1969 the Nanchang factory started producing the Q-5 (A-5) attack aircraft, various versions of which remained in production until 1987. Prototype manufacturing of the J-12 light fighter was undertaken in 1970 and 1975.

In 1992 the Hongdu Aviation Industries Group launched low-rate production of the N5A agricultural aircraft. Current programmes include the JL-8/K-8 advanced trainer (produced jointly with Pakistan) and the L15 supersonic fighter trainer.

In early 2003 HAIG created a subsidiary named Hongdu MD Helicopters (HMDH) to assemble MD 500 and MD 600 series helicopters from US-supplied kits.

Shaanxi Aircraft Industry Group

The Shaanxi Aircraft Company (SAC, or *Shaanxi Feiji Gongye Gongsi*) was established in November 1969 in Hanzhong south of Xi'an, the capital of Shaanxi Province. Its status was upgraded to Industry Group in 2001. Currently the company is led by President Hu Xiaofeng, with Ouyang Shaoxiu as Vice-President. In 2003 SAC had a workforce of more than 10,000.

So far the sole product of the Shaanxi Aircraft Industry (Group) Co. is the Y8 four-turboprop medium transport, numerous versions of which have been in production since 1975. However, the company is developing a successor in the form of the Y9 four-turboprop transport. Non-aerospace products include coaches and lorries.

Shijiazhuang Aircraft Industry Corporation

The Shijiazhuang Aircraft Industry Corporation (SAIC, or *Shijiazhuang Feiji Gongye Gongsi*) is located in Shijiazhuang, Hebei Province. Prior to that it was part of the Xian Aircraft Industrial Group since July 1992, but was reassigned to AVIC II when the former AVIC giant split in 1999. The company is controlled by General Manager Cheng Bingyou.

SAIC came into existence in 1970 as the State aircraft factory No. 164, alias the Shijiazhuang Red Star Machinery Factory. Its first (and, for many years, only) product was the Y-5 biplane, more refined versions of which were developed in due course; the Y-5B model entered production in 1989. Currently SAIC manufactures the Qingting-5 (aka W-5) microlight aircraft and the LE-500 Little Eagle

single-engine cabin monoplane and plans to produce the LE-800 business turboprop; this makes it the only major Chinese company producing general aviation light aircraft.

South Aero Engine Co.

Based at Zhuzhou near Changsha, Hunan province, this plant established in 1951 was known at various points of its history as the Zhuzhou Engine Factory (ZEF) and the South Motive Power & Machinery Co. (SMPMC). It started by overhauling the M-11FR five-cylinder radial engine in 1952 and then launched production of it in 1954. This was followed by production entry of the HS-5 and HS-6 nine-cylinder radial engines in 1958 and 1960 respectively; uprated HS-6A, HS-6B and HS-6C versions appeared in 1965, 1966 and 1963.

Turboprop engine production at Zhuzhou began in 1965 with the experimental WJ-5 but further development took place at Harbin. The WJ-6 turboprop was also produced by this plant (the prototype was built in 1970 and low-rate production commenced in 1977). In 1980 ZEF started production of the WZ-8 turboshaft.

Zhuzhou Aero Engine Research Institute

This establishment was set up in 1968 specifically to undertake development of the WZ-5 turboshaft derived from the WJ-5 (initial development had taken place at ZEF). The engine commenced bench tests in 1969. The uprated WZ-5A followed in 1970; neither engine reached production.

Aircraft engineering centres

As mentioned earlier, AVIC II has set up an aircraft engineering centre with Airbus Industrie and AVIC I. The Chinese companies are to design up to 5% of the A350XWB long-haul airliner's airframe. Airbus owns 70% of the joint venture, with AVIC II and AVIC I holding 25% and 5% respectively.

On 19th September 2007, the opening day of the Aviation Expo China 2007 trade fair in Beijing, Shaanxi Aircraft Industry (Group) Co. and the Ukraine-based Antonov Aeronautical Scientific & Technical Complex (ASTC) signed a framework agreement to set up an engineering centre in Beijing by the end of the year. The centre was to design a freighter version of a large aircraft to be developed in China by 2010, AVIC II Vice-President Liang Zhenhe

Yang Chunshu, President of the CATIC corporation.

said. It would also design light and medium transport aircraft and improve the existing Y-8 turboprop transport.

Shaanxi Aircraft would hold the controlling share in the joint venture, with the initial investment being about 10 million yuan (US$1.29 million).

CATIC

AVIC I and AVIC II each own 50% of CATIC (China National Aero-Technology Import & Export Corporation) founded in 1979. It is currently headed by President Yang Chunshu.

CATIC is a large transnational conglomerate whose main business is the import and export of aviation products, technology, labour services, equipment and materials. CATIC has ten domestic subsidiaries, seven specialised member companies (engaged in such activities as international trade and economic development, investment, freight forwarding, leasing and so on) and over 60 subsidiaries and

The CATIC headquarters building in Beijing.

branch offices in 30 countries in Asia, Africa, North and South America, Europe and Oceania. CATIC ensures timely and high-quality product support for Chinese-built aircraft delivered overseas by keeping a network of spares depots in China and abroad.

CACC

A new aircraft manufacturer named Commercial Aircraft Corporation of China Ltd. (CACC) was officially established on 11th May 2008. The fledgling company was formed specifically for developing, manufacturing and marketing China's first-ever wide-body airliner. This is a programme currently being accorded high priority at the top level, as indicated by the fact that Chinese Vice-Premier Zhang Dejiang and Shanghai Communist Party of China (CPC) chief Yu Zhengsheng attended the company's inauguration ceremony.

CACC is based in Shanghai, with Shanghai Aircraft Manufacturing Factory and the First Aircraft Institute of AVIC I as the main participants. It has a registered capital of 19 billion yuan (US$ 2.7 billion). The State-owned Assets Supervision and Administration Commission invested 6 billion yuan, becoming the biggest shareholder; other major stockholders are AVIC I and AVIC II. Zhang Qingwei, head of the State Commission of Science, Technology and Industry for National Defence, was appointed chairman of CACC's board of directors; Jin Zhuanglong is the company's general manager.

The creation of CACC was approved by the State Council (China's cabinet of ministers) in February 2007. It will take some time to train the engineering talent, and the actual design work will start during the 11th Five-Year Plan, with production expected to begin by 2020. Therefore, the newcomer will pose no immediate threat to established makers of large jets like Boeing and Airbus.

For starters, CACC has taken over responsibility for the ARJ21 regional jet programme previously run by ACAC. The goals of the first few years include taking the ARJ21 into the air and establishing production. Later, the corporation is to develop a 'small wide-body' airliner with a take-off weight of more than 100 tonnes (220,450 lb) and a seating capacity of around 200, with a possible military transport/tanker version.

China is now actively developing new aircraft, and Chinese test pilots are having a busy time.

Test pilots

Mention should be made of at least a few test pilots who put Chinese aircraft through their paces. These are: Duan Xianglu (CJ-5, 1954); Ge Shun (K-8, 1990); Ge Wenrong (J-7, 1966); Hua Jun (J-8, 1969-79); Huang Zhaolian (CJ-6, 1960); Li Benshung (Y7, 1970); Li Jungrui (Y8, 1974); Li Yuanyi (H-6, 1968); Li Zhonghua (J-10, 1996); Liu Jianfan (JZ-6, 1971); Liu Xingxiang (Z5, 1958); Lu Mindong (J-8, 1969-79 and J-8 I, 1981); Pan Guoding (Beijing-1, 1958); Qian Guangyou (Z5, 1958); Qu Xueren (J8 II, 1984); Su Guohua (J-8, 1969-79); Tan Shikun (Q-5B, 1970); Tuo Fenming (Q-5 1965); Wu Keming (J-5, 1956 and J-6, 1959); Wang Ang (J-8, 1969-79); Wang Chunyou (JJ-6, 1970); Wang Jinda (Y10, 1980); Wang Peiming (Z6, 1969); Wang Wenying (H-5, 1966); Wang Youhuai (J-6A, 1958 and J-6B, 1959); Xu Guocun (Y8, 1985); Xu Wenhong (H-6, 1968); Yan Xiufu (JJ-7, 1985); Yang Yao (L-15); Yin Yuhuan (J-8, 1969); Yu Mingwen (J-7 II, 1978 and J-7 III, 1984); Yu Zhenwu (JJ-1, 1958); and Zhang Jingting (L-15). The year stated is the year of the maiden flight.

2 The Fighters

'63833 Red', a Shenyang JJ-2 trainer, at the PLAAF Museum.

Jet fighter development understandably received the highest priority in China from the outset, as not only was there war next door in Korea (in which China was involved directly, albeit unofficially) but China had the US-backed breakaway Taiwan to deal with. As with most aspects of the Chinese aircraft industry, China started off by reproducing Soviet designs, then began development of indigenous versions that had no Soviet counterparts, and finally proceeded to develop purely Chinese designs unrelated to any Soviet aircraft.

The fighter families produced in China are listed here in chronological order, rather than in designation order. Conversion trainer variants are also included if they are based on an existing fighter airframe, as distinct from those basic and advanced trainers that qualify as separate designs and are listed in Chapter 5.

Shenyang JJ-2 (FT-2) advanced trainer

When the Chinese government first decided to build jet aircraft in March 1950, the most modern Soviet jet fighter of the time – the MiG-15*bis* (NATO reporting name *Fagot-B*), which Chinese pilots flew with some success in the Korean war alongside their Soviet colleagues – was chosen for licence production. Eventually the plans to build the MiG-15*bis* were abandoned in favour of the more advanced MiG-17F (see below). However, the UTI-MiG-15 trainer (NATO reporting name *Midget*) was produced by the Shenyang aircraft factory (now the Shenyang Aircraft Industry Complex, SAIC). The Chinese-built version was designated JJ-2 (*Jianjiji Jiaolianji* – fighter trainer, type 2) because, despite not being built locally, the MiG-15*bis* was reportedly allocated the local designation J-2 (*Jianjiji* – fighter, type 2).

'5-09', one of the FT-2s delivered to the Albanian Air Force, preserved at Kuçovë AB.

'12014 Red', a Ba-5 target drone, takes off, showing the empty cockpit. The badge on the tail is that of the design bureau.

Another Ba-5 is prepared for flight.

The 2,270-kgp (5,000-lbst) Klimov RD-45F non-afterburning centrifugal-flow turbojet powering the MiG was built under licence in Harbin but did not receive a local designation. In addition to serving with China's PLAAF and PLANAF, the JJ-2 was exported as the FT-2 (that is, Fighter Trainer). Foreign operators were Albania, Bangladesh, North Korea, Pakistan, Sudan, Tanzania and North Vietnam.

Ba-5 target drone

After running out of service life some of the PLAAF's MiG-15*bis* fighters were converted into remote-controlled target drones designated Ba-5 for training fighter pilots and surface-to-air missile crews. The guidance equipment was installed in the cockpit, replacing the ejection seat.

This flight line features some of the earliest production J-5s, as indicated by the serials prefixed by the *Zhong* hieroglyph.

A publicity shot of PLAAF J-5s equipped with drop tanks.

J-5 fighter family

Chinese licence production of the MiG-17 (NATO reporting name *Fresco*) – an upgraded derivative of the MiG-15 with wing sweepback increased from 35° to 45°, a longer fuselage and a more powerful engine – has been the subject of some controversy until recently. Contrary to claims by some Western sources, the original MiG-17 *sans suffixe* day fighter with the 2,700-kgp (5,925-lbst) non-afterburning VK-1A engine was never built in China; Chinese *Fresco-As* were Soviet-supplied. However, as with the MiG-15*bis*, they reportedly received the local designation J-4; some were resold to other nations as the F-4.

Shenyang J-5 (F-5) tactical fighter (Dongfeng-101, Type 56)

In October 1954 China decided to build the MiG-17F *Fresco-C* day fighter. It was powered by the VK-1F afterburning turbojet rated at 2,600 kgp (5,730 lbst) dry and 3,380 kgp (7,450 lbst) reheat; as on the earlier version. The armament comprised one 37-mm (1.45 calibre) Nudel'man N-37D cannon with 40 rounds and two 23-mm (.90 calibre) Nudel'man/Rikhter NR-23 cannons with 80 rounds per gun. This fighter had first flown on 29th September 1951 and was then the current production version.

A manufacturing licence was obtained, and the manufacturing documents were handed over in 1955 together with two pattern aircraft, 15 completely-knocked-down (CKD) kits and materials for a further ten aircraft. The Soviet Union also supplied the jigs and tooling and proposed a four-stage programme facilitating production entry.

The Shenyang Aircraft Factory started assembly of the first MiG-17F from Soviet components on 8th April 1955; the first fighter made entirely of locally manufactured components was completed on 13th July 1956. A static test airframe was successfully tested to destruction on 26th July.

Meanwhile, serialled *Zhong* 0101 (the hieroglyph 'Zhong' is the first part of China's native name, *Zhong-Guo*), the first locally-manufactured aircraft (construction number 0101 – that is, Batch 01, 01st aircraft in the batch) made its first flight on 19th July 1956 at the hands of factory test pilot Wu Keming. The flight tests continued until 2nd August that year. On 8th September the State Committee cleared the machine for full-scale production. The prototype was ultimately preserved at the People's Liberation Army Air Force Museum in Datangshan (now called Xiaotangshan) near Beijing and listed as an 'Important Historical Monument' (!) by the Chinese government.

The licence-built version was originally known locally as the Dongfeng-101 (East Wind-101) and Type 56 but was redesignated J-5 in 1964. The VK-1F turbojet entered licence production at the Harbin Engine Factory as the WP-5 (Wopen-5 – turbojet engine, type 5), or TJ-5 for export; the first engine passed acceptance trials on 19th June 1956. The J-5's performance was almost identical to that of the Soviet-built MiG-17F. Export J-5s were designated F-5 and supplied primarily to Albania.

'31092 Red', a PLAAF J-5, with the airbrakes open.

'4-10', a J-5 in faded late-style Albanian Air Force markings.

Chengdu J-5A (J-5 Jia, F-5A) interceptor

To meet a PLAAF requirement for an all-weather interceptor, China obtained a licence to manufacture the early production version of the MiG-17PF (NATO reporting name *Fresco-D*). This version featured an RP-1 Izumrood-1 radar in a longer nose, with a search antenna built into the air intake upper lip and a tracking antenna housed in a small hemispherical intake centrebody). The cockpit windshield

JJ-5 '518 White' operated by the PLAAF's 'August 1st' display team. Note the smoke generator pods.

J-5A '51623 Red' is prepared for a night sortie, showing off the twin radomes.

J-5A '2074 Red' is on display at the PLAAF Museum. Note the additional pylons, probably for AAMs.

J-5 '2424 Red', now likewise at the PLAAF Museum, was converted into a radar testbed with a bulbous radome.

was redesigned to accommodate the gunsight and the radar display. The armament consisted of three NR-23 cannons.

Unlike the day fighter version, the Bureau of Aircraft Industry picked the Chengdu Aircraft Factory (now the Chengdu Aircraft Corporation, CAC) to build the interceptor in May 1961; the Chinese version was designated J-5A or J-5 Jia. The Shenyang factory sent a team of specialists to Chengdu to provide help, as well as a complete set of jigs and tooling. Manufacturing drawings were completed at Chengdu in 1962, and the first metal was cut in March 1963. The static test airframe (c/n 01) was completed in June 1964 and static tests continued until September. Finally, on 11th November 1964 the unserialled J-5A prototype (c/n 02) made its first flight at Yanliang airfield near Xian at the hands of Wu Youchang. Certification was obtained same year and the interceptor entered production in 1965. The export version was designated F-5A (F for fighter).

A total of 767 single-seat J-5s (the proportion of 'pure' J-5s and J-5As is unknown) had been built when production ended in 1969; peak output was 25 aircraft per month.

Shenyang J-5 torpedo bomber

To meet a PLANAF requirement the Shenyang factory developed a torpedo-bomber version of the MiG-17F (J-5). The heavy torpedo was carried under the fuselage; this required one of the cannons to be removed and the fuel load to be reduced so as not to exceed the MTOW. Trials showed that performance (except field performance) had deteriorated sharply as compared to the standard J-5 because of the high drag generated by the torpedo and the reduced fuel capacity. Thus the torpedo bomber did not progress beyond the prototype stage; work in this direction continued with the Nanchang Q-5B (see Chapter 4).

Shenyang J-5 avionics testbed (?)

At least one J-5 serialled '2424 Red' was converted into an avionics testbed for an unidentified Chinese radar. The radar antenna was housed in a bulbous radome on the intake's upper lip; the aircraft's appearance was thus quite similar to the Soviet SP-2 – an experimental version of the MiG-15 equipped with a Korshun (Kite, the bird) radar that presaged the MiG-17P/PF.

Chengdu JJ-5 (FT-5, F-5T) advanced trainer (product 55?)

In 1964 the Chinese aircraft industry began development of an advanced trainer derivative of the J-5, a successor to the JJ-2 which could not quite meet the PLAAF's requirements. Designated JJ-5, it had no Soviet equivalent; it was a cross-breed between the UTI-MiG-15 and the MiG-17, combining the former's cockpit section mated to a MiG-17 airframe. That is to say, the crewmembers sat in tandem, the trainee's canopy section opening to starboard and the instructor's canopy section sliding aft. The shape of the nose resembled the MiG-17PF (J-5A) with its characteristic 'fat lip'; yet the aircraft had no radar, the nose was all-metal and there was no intake centrebody. With an overall length of 11.5 m (37 ft 8¾ in), the aircraft was 140 mm ($5^{53}/_{64}$ in) longer than the J-5A; the other dimensions were identical.

The JJ-5 was powered by a WP-5D (alias TJ-5D) non-afterburning turbojet – the Chinese equivalent of the VK-1A manufactured by the Xian Engine Factory – rated at 2,700 kgp (5,952 lbst), with a rear fuselage shape similar to that of the MiG-17. Yet, it had 0.97-m^2 (10.43-sq ft) airbrakes borrowed from the MiG-17F/MiG-17PF (J-5). In other words, it was the *Fresco-A*, *Fresco-C*, *Fresco-D* and *Midget* all rolled into one!

The Chinese engineers chose to eliminate the built-in weapons tray which was a distinctive feature of the MiG-15 and MiG-17 (J-5). Instead, the JJ-5 had a single 23-mm (.50 calibre) Type 23-1 (NR-23) cannon mounted low on the starboard side of the nose. Additional pylons for air-to-ground weapons could be fitted outboard of the drop tank hardpoints. The cockpits were equipped with an intercom and semi-automatic ejection seats; the seats could not be used safely below 260 m (853 ft) at

An FT-5 demonstrator with the Chengdu company serial CAC0133 on final approach in 1995.

Another view of the same aircraft, which also has the non-standard PLAAF serial '950133 Red'.

Two PLAAF pilots pose with JJ-5 '64673 Red' operated by the 7th Flight Academy, Changchung.

'63641 Red', a JJ-5 of the 4th Flight Academy at Cangzhou, shows the distinctive bulged intake upper lip.

55-1206, a typical Pakistan Air Force FT-5.

PAF FT-5s of the 1 Fighter Conversion Unit 'Rahbers' at Mianwali AB.

Sri Lanka bought two FT-5s. The second aircraft, CTF702, is shown at Katunayake.

speeds up to 350 km/h (217 mph) or below 2,000 m (6,560 ft) at higher speeds.

Prototype construction began on 25th March 1965 and the prototype made its first flight on 8th May 1966. After completing its flight test programme the trainer entered production at Chengdu. (Some sources claim the JJ-5 was built by the Shenyang aircraft factory as well. The JJ-5 has two c/n systems, which appears to support this theory. One system (Chengdu production?) is straightforward – for example, 1609 (batch 16, ninth aircraft in batch). The other system (Shenyang production?) is a little more complicated – for example, 55-1206; the first two digits may be an in-house product code. However, it is just possible that this '55-' prefix was simply dropped after a certain number of batches had been built.)

Deliveries to the PLAAF began on 30th November 1967; a total of 1,061 examples had been built when production ended in late 1986. The trainer was also exported as the FT-5; known export customers are Albania (35), Bangladesh, Pakistan (20), Sri Lanka (2) and Zimbabwe (2). Curiously, several publications called this aircraft 'MiG-17UTI' in the erroneous belief that it was a straight copy of an existing Soviet design!

Chengdu JJ-5 aerobatic version

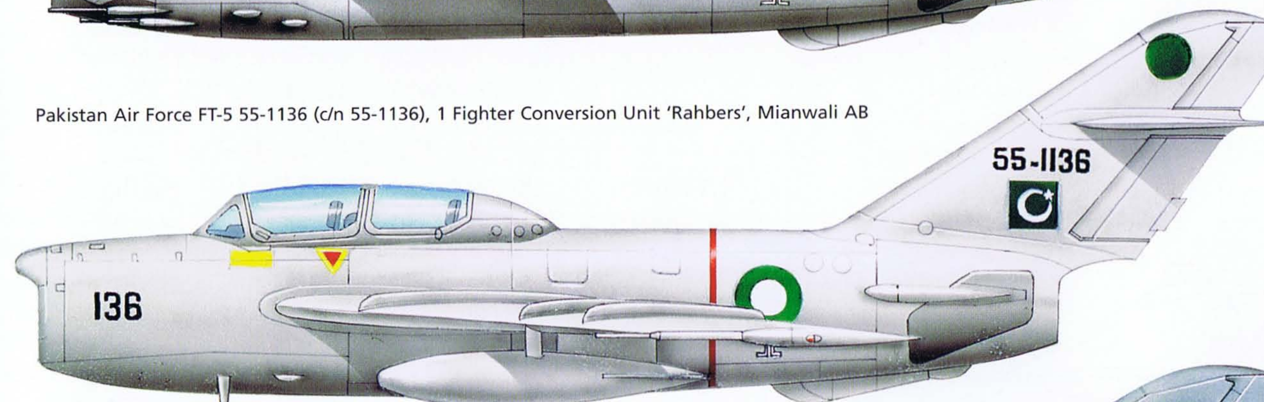
In addition to the PLAAF's flying academies, the JJ-5 served as the mount of the PLAAF's 'August 1st' display team for a while. The

'4-65', an Albanian FT-5 operated by the 4030th Regiment at Kuçovë AB.

PLANAF J-5 '83065 Red', 6th Naval Division

PLAAF J-5 '2533 Red' with a red upper fin section for quick identification; it was later delivered to North Vietnam

Pakistan Air Force FT-5 55-1136 (c/n 55-1136), 1 Fighter Conversion Unit 'Rahbers', Mianwali AB



Pakistan Air Force FT-5 55-1208 (c/n 55-1208) in two-tone camouflage

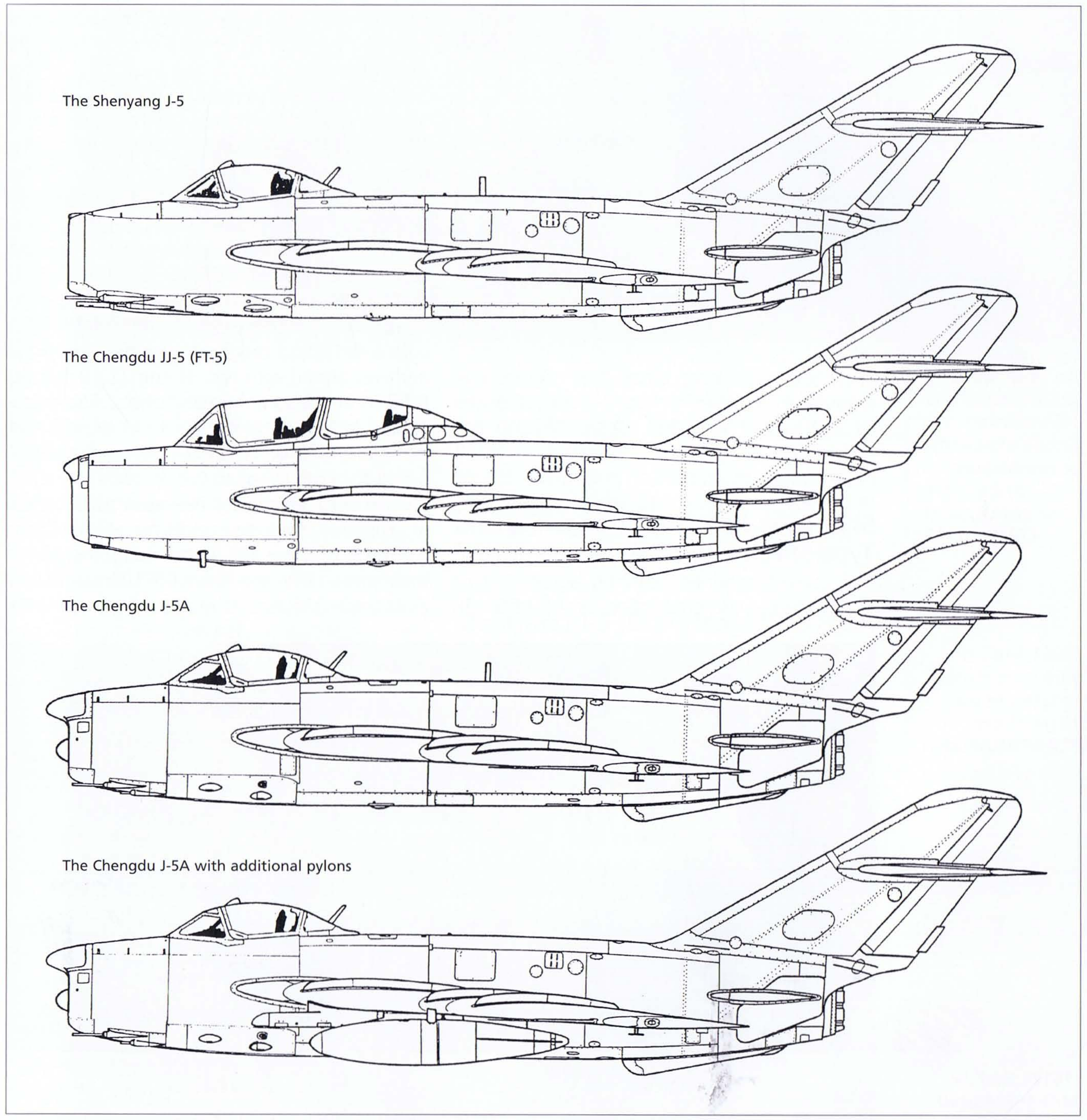
Bangladesh Air Force FT-5 '724' (c/n 1724), Tezgaon AB, Dhaka

Specifications of the J-2/J-5 family

	JJ-2	J-5	J-5A	JJ-5
Powerplant	RD-45F	WP-5	WP-5	WP-5D
Thrust, kgp (lbst):				
dry	2,270 (5,000)	2,600 (5,730)	2,600 (5,730)	2,270 (5,000)
reheat	–	3,380 (7,450)	3,380 (7,450)	–
Overall length	10.11 m (33 ft 2 1/32 in)	11.09 m (36 ft 4 3/32 in)	11.36 m (37 ft 3 15/64 in)	11.5 m (37 ft 8 3/4 in)
Wing span	10.08 m (33 ft 0 27/32 in)	9.628 m (31 ft 7 3/64 in)	9.628 m (31 ft 7 3/64 in)	9.628 m (31 ft 7 3/64 in)
Height on ground	3.7 m (12 ft 1 43/64 in)	3.8 m (12 ft 5 19/32 in)	3.8 m (12 ft 5 19/32 in)	3.8 m (12 ft 5 19/32 in)
Wing area, m² (sq ft)	20.6 (221.5)	22.6 (243.0)	22.6 (243.0)	22.6 (243.0)
Empty operating weight, kg (lb)	3,694 (8,143)	n.a.	4,151 (9,151)	4,080 (8,995)
Take-off weight, kg (lb)	4,850 (10,690)	5,354 (11,803)/ 6,000 (13,230)*	5,620 (12,389)/ 6,000 (13,230)*	5,401 (11,907)/ 6,215 (13,700)*
Fuel capacity, litres (Imp gal):				
internal	1,080 (237.6)	1,410 (315.7)	1,395 (306.9)	1,500 (330)
with 400-litre (88 Imp gal) drop tanks	1,880 (413.6)	2,235 (491.7)	2,195 (482.9)	2,300 (506)
Top speed, km/h (mph):				
at 5,000 m (16,400 ft)	1,010 (627)	1,130 (701)	1,145 (711) ‡	1,048 (566.48)
at 10,000 m (32,810 ft)	963 (598)	1,071 (665)	n.a.	902 (487.56) §
Service ceiling, m (ft):				
in full afterburner	–	15,100 (49,540)	14,450 (47,408)	–
at full military power	14,625 (14,625)	16,470 (54,035)	16,300 (53,477)	14,300 (46,916)
Rate of climb, m/sec (ft/min):				
at 5,000 m	26.4 (5,200)	65.0 (12,795)	55.0 (10,830)	27 (5,315) †
at 10,000 m	14.5 (2,850)	38.4 (7,560)	32.3 (6,360)	n.a.
Time to height, minutes:				
to 5,000 m	2.6	2.1	2.5	n.a.
to 10,000 m	6.8	3.7	4.5	n.a.
to 15,000 m (49,210 ft)	–	7.4	9.8	n.a.
Range at 10,000 m, km (nm):				
on internal fuel	950 (513)	1,080 (583)	1,100 (594)	
with 400-litre drop tanks	1,424 (769)	1,670 (902)	1,730 (935)	1,230 (664)*
Take-off run, m (ft)	570 (1,870)	590 (1,804)	730-930 (2,395-3,051)	760 (2,493)
Landing run, m (ft)	740 (2,427)	n/a	885 (2,903)	780-830 (2,559-2,723)
Armament:				
machine-guns	1 x 12.7-mm	–	–	–
cannons	–	1 x Type 37 2 x Type 23-I	3 x Type 23-I	1 x Type 23-I

* Normal/maximum TOW. Some sources state the JJ-5's MTOW as 6,087 kg (13,419 lb) and maximum range as 1,160 km (627 nm).
† At sea level
‡ At 3,000 m (9,840 ft)
§ At 9,750 m (31,988 ft)

team's aircraft wearing a smart red/white livery were equipped with a smoke generator system injecting a mixture of diesel fuel and dye into the engine jetpipe; a supply of the mixture was carried in two slender cigar-shaped tanks attached to the standard drop tank hardpoints. Additionally, at least one of the team's JJ-5s (serialled '507 White') had a non-standard curved windscreen instead of the usual three-piece windshield.



J-6 fighter family

In the mid-1950s Soviet fighter aviation entered the supersonic era with the MiG-19 (NATO reporting name *Farmer*). Taking the line of development begun with the MiG-15 and MiG-17 further, the aircraft had sharply swept mid-set wings, swept tail surfaces (conventional ones this time) and a nose air intake. The powerplant was a pair of Mikulin AM-9B (RD-9B) afterburning turbojets located side by side in the rear fuselage.

China decided it should follow suit; hence licence manufacturing rights for the type were obtained in 1957. It may be said that Chinese licence production turned the MiG-19 into a champion of longevity among fighters – the type was produced for 32 years (1954-1986). As a result, the *Farmer*'s production run beyond the Great Wall more than doubled that in the fighter's country of origin. True to type, the Chinese brought out into a number of indigenous versions, including one different enough to qualify as a separate type – the Q-5 attack aircraft (see Chapter 4). Moreover, they

An unserialled prototype of the J-6A cannon-armed all-weather interceptor.

succeeded in doing what their Soviet colleagues had failed to do – improving the MiG-19's poor reliability record (though not overnight).

Shenyang J-6A (Dongfeng-103, Type 59A, Jianjiji-6 Jia) interceptor

The abovementioned licensing agreement of 1957 covered the production of the MiG-19P

'0001 Red', the J-6A prototype, in late camouflage at the PLAAF Museum.

Farmer-B all-weather interceptor and the RD-9B engine. This was soon followed by a supplementary agreement concerning the MiG-19PM and then in late 1959, shortly before the break between Moscow and Beijing, by a third agreement for the MiG-19S day fighter.

The Bureau of Aircraft Industry tasked the Shenyang Aircraft Factory with building the aircraft. The RD-9B turbojet was to be manufactured as the WP-6 – originally by the Liming factory, also located at Shenyang; later, engine production was transferred to Chengdu.

In early 1958 the Shenyang factory started gearing up to build the MiG-19P. This version had an RP-5 Izumrood-2 radar (the same model as fitted to late-production MiG-17PFs) with a detection range of 12 km (7.46 miles) and was armed with two 30-mm (1.18 calibre) NR-30 cannons in the wing roots. The interceptor initially received the local designation Dongfeng-103 or Type 59A but was redesignated Jianjiji-6 Jia, aka J-6A, in 1964.

Five MiG-19Ps were delivered as CKD kits in March 1958 for starting production. Assembly of these kits began straightaway but took some time; the first MiG-19P assembled at Shenyang made its maiden flight on 17th December 1958 at the hands of Wang Youhuai. In April 1959 it was certificated by the State Certification Commission.

However, back in May 1958 Mao Zedong's government had launched the notorious plan of accelerated industrial development called the 'Great Leap Forward'. As mentioned earlier, the plan backfired dismally and the industry was effectively disorganised. Also, at first the Chinese authorities decided they could set up J-6 production without Soviet help and ordered the tooling to be manufactured locally. This turned out to be a big mistake.

Full-scale production began in April 1959. However, trying to crank out as many fighters as possible, the factory let quality standards slip. The same held true for early-production WP-6 turbojets – this engine turned out to be far more complicated to build than the WP-5 previously produced by Liming; only in late 1960 did the quality improve perceptibly.

'14121 Red', a MiG-19PM used as a pattern aircraft for the missile-armed J-6B.

'3171 Red', a JZ-6 photo reconnaissance aircraft whose pilot defected to South Korea on 7th July 1977.

As a result, most of the aircraft completed in 1959 and 1960 were deemed substandard and not accepted by the PLAAF. Eventually production had to be halted, all the jigs were thrown away and new ones made – with Soviet assistance this time.

The Shenyang factory resumed production in 1961 with new jigs. Unlike the aircraft built in 1958-60, which were armed with NR-30s, the 'new-production' J-6As had Type 23-2 cannons (a Chinese derivative of the NR-23) – just as had been the case with the baseline J-6. However, the interceptor turned out to be a bit too complicated to build for this plant and production was transferred to the smaller factory in Nanchang in Jiangxi Province which was trying to transition from propeller-driven aircraft to jets. Yet this factory, too, managed to complete only seven J-6As in two years.

Shenyang J-6 (Dongfeng-102, Type 59, F-6) tactical fighter (product 47)

Despite the designation with no suffix letter, the radar-less J-6 day fighter (initially called Dongfeng-103 or Type 59) actually appeared later than the J-6A. The J-6 was roughly equivalent to the MiG-19S *Farmer-C* (to be precise, the late-production version with a slightly longer fin fillet), but they were not identical

A propaganda shot showing the flight line of a PLANAF unit flying J-6s (note the pilots' life jackets) The nearest aircraft is c/n *Jianjiji* 6-6631.

The J-6 final assembly shop at the Shenyang Aircraft Factory.

twins. Outwardly the Chinese version differed from the Soviet original in having the pylons (used for carrying unguided rocket pods) mounted at the wing leading edge rather than aft of the mainwheel wells, an emergency pitot head located to starboard rather than to port and only two cooling air scoops under each all-movable tailplane instead of four.

The first J-6 took to the air on 30th September 1959 with test pilot Wu Keming at the controls. However, the day fighter version initially suffered from the same quality problems as the interceptor, and the result was the same. By the end of 1960 production had ground to a halt and the Shenyang factory airfield was choked with J-6s and J-6As undeliverable due to poor manufacturing quality.

Production of entirely Chinese-built J-6s meeting the quality standards finally began in December 1963, though some sources claim the first 'new-production' J-6 flew on 23rd September 1963. Again, most of these 'new-production' J-6s were armed with Type 23-2 long-barrelled cannons; some had the short-barrelled version of the same weapon. A few retained the Type 30-1 (NR-30) cannons, albeit in modified form with large muzzle brakes. Finally, some of the avionics and flight instruments were different (Chinese derivatives of the original Soviet ones).

Export J-6s bore the designation F-6, while the WP-6 engines were designated TJ-6 for export.

Production was mostly in batches of 40 aircraft, though some batches are known to contain up to 60. There were two construction number systems. One is straightforward – e.g., #6-6631 (that is, J-6, batch 66, 31st aircraft in batch); the # represents a hieroglyph standing for *Jianjiji*. The other system is a little more complicated – e.g., 47-1825; the first two digits are an in-house product code or a code denoting the factory. The second system appears to apply to export aircraft and has been noted on some F-6s delivered to Pakistan.

Shenyang (Guizhou) J-6A missile upgrade

In 1974 the Guizhou aircraft factory (now GAIGC) upgraded the J-6A interceptor with two PL-2 infrared-homing air-to-air missiles carried on pylons outboard of the drop tanks. The PL-2 was a licence-built version of the K-13A, itself a reverse-engineered AIM-9 Sidewinder, with different avionics; PL stood for *Pi Li* (Thunderbolt), which was a generic codename for air-to-air missiles. The prototype conversion made its maiden flight on 21st December 1975.

Night scene at a naval airbase, with J-6As taxying out past a line of J-6 day fighters.

Nanchang J-6B (Jianjiji-6 Yi, Dongfeng-105, Type 59B) interceptor

The plans to produce the J-6A in Nanchang came to nothing. This factory concentrated instead on the more capable MiG-19PM interceptor (NATO reporting name *Farmer-D*) armed with RS-2-US (K-5M) beam-riding AAMs. The licence-built *Farmer-D* was initially known as the Dongfeng-105 and Type 59B but redesignated Jianjiji-6 Yi or J-6B in 1964.

Once again, production started with five CKD kits supplied by the Soviet Union in March 1958; the first 'kit-built' aircraft took to the air on 28th September 1959 with Wang Youhuai at the controls. On 28th November it was cleared for PLAAF service by the State Certification Commission.

Building the J-6B was no small task, especially given the complications of the 'Great Leap Forward' and the difficult transition from piston-engined aircraft to jets. The Nanchang factory built only 19 J-6Bs, whereupon the programme was mothballed.

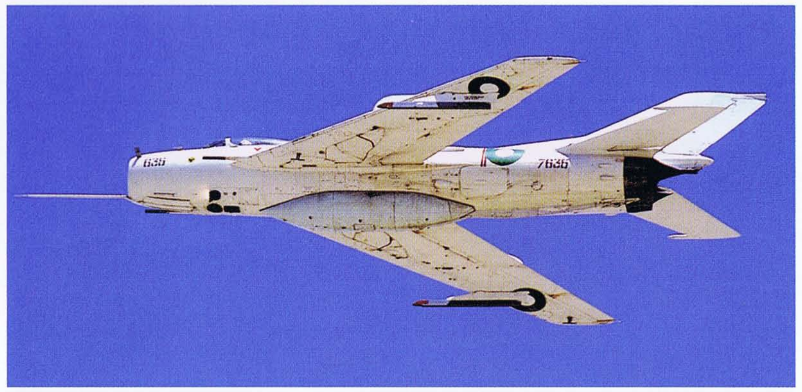
A second try was made in 1974, possibly using the 12 Soviet-built MiG-19PMs acquired from Albania in 1965 as pattern aircraft. Tests of the 'reborn' J-6B were completed in 1976 and the interceptor entered limited production next year. The RS-2-US AAM was built under licence at Zhuzhou as the PL-1.

An Egyptian Air Force F-6C serialled 2808. Note the shape of the gun blast plates.

The J-6B differed from the Soviet-built MiG-19PM in having the brake parachute relocated to a bullet fairing at the base of the fin in the manner of the J-6C day fighter (see below). One of the development aircraft serialled '14121 Red' was unusual in retaining two Type 23-2 cannons in the wing roots which were deleted on most aircraft. This particular example is now preserved at the PLAAF Museum in Datangshan (now Xiaotangshan) near Beijing.

North Korean Air Force F-6C '529 Red' at Suwon AB following the pilot's defection on 23rd May 1966.

A trio of late-production F-6Cs operated by the Pakistan Air Force's 15 Sqn 'Cobras' at Kamra.



F-6C '7636' of the PAF's No. 19 Air Superiority Sqn carries a conformal fuel tank.

'3243 Red', a JZ-6, shows the lowered camera pallet aft of the nose gear unit.

Shenyang J-6C (Jianjiji-6 Bing, F-6C) tactical fighter (product 55)

The design bureau of the Shenyang factory soon set about making modifications to the basic J-6. The brake parachute was relocated from its ventral compartment to a prominent bullet-shaped fairing at the base of the fin (thus the space below the rudder was put to good use at last). The reason for this modification was that the original brake parachute caused the aircraft to pitch down sharply. This meant it could only be deployed safely when the nosewheel was firmly on the ground. Conversely, a parachute located above the thrust line caused the fighter to pitch up, increasing drag; hence it could be deployed immediately after touchdown, reducing the landing run dramatically.

Less obvious changes were made to the flaps and airbrakes to increase their efficiency. The standard WP-6 engines gave place to WP-6As – a locally-developed version of the RD-9BF-811 rated at 3,000 kgp (6,614 lbst) dry and 3,752 kgp (8,267 lbst) reheat. New hydraulic systems were installed and more powerful control surface actuators fitted.

Designated Jianjiji-6 Bing or J-6C, the aircraft entered flight test on 6th August 1969; the prototype was probably white overall and serialled '112 Red'. The J-6C was built in quantity, equipping more than 40 PLAAF and Naval Air Arm (PLANAF) units. The export designation was F-6C; judging by the construction numbers of some Pakistani aircraft, the in-house product code at Shenyang was 55-.

Like the original J-6, most J-6Cs were armed with three Type 23-2 cannons. Some aircraft, however, had Type 30-1 cannons with large muzzle brakes; moreover, Egyptian F-6Cs fitted with the heavy cannons featured non-standard trapezoidal blast panels.

Pakistani F-6s and F-6Cs were upgraded after delivery, including the integration of AIM-9B/L Sidewinder AAMs, Western avionics and the fitment of Martin-Baker PKD10 (Mk. 10L) zero-zero ejection seats. The standard Chinese ejection seats developed from the Soviet KK-1 could not be used safely below 260 m (853 ft) and 350 km/h (188 kts).

Shenyang JZ-6 (FR-6) tactical reconnaissance aircraft

In 1966 the Shenyang design bureau began development of a tactical reconnaissance version of the J-6 equivalent to the MiG-19R. The aircraft was optimised for low/medium-altitude photo reconnaissance (PHOTINT) in visual meteorological conditions. A battery of four oblique cameras and one vertical camera was installed in the forward fuselage, necessitating removal of the nose cannon; the vertical camera was enclosed by a shallow fairing. Two of the oblique cameras had rectangular ports, while the others had circular ports. The cameras were mounted on a pallet which could be winched down for reloading. The armament consisted of two Type 23-2 cannons with 100 rpg.

Designated JZ-6 (*Jianjiji Zhenchaji* – reconnaissance fighter), the aircraft entered limited production in 1967. The export designation was FR-6 (fighter/reconnaissance) but it is not known if any were actually exported. A similar reconnaissance version of the improved J-6C was developed later; no separate designation (JZ-6C etc.) has been quoted.

Two production JZ-6s were modified for high-altitude PHOTINT in 1971. There are reasons to believe these aircraft were converted from late-model JZ-6s built to J-6C standard – or possibly 'basic' (non-reconnaissance) J-6Cs. This version had a canoe fairing with camera ports stretching all the way from the nose gear unit to the ventral airbrake. It made its first flight on 2nd April 1971 with Liu Jianfan at the controls.

Five years later another aircraft was converted into a more versatile reconnaissance platform suitable for both high-altitude and low-altitude missions. In addition to the usual cameras this aircraft was equipped with an infra-red scanner.

This unserialled JJ-6 is the prototype with a ventrally stowed brake parachute.

'116 Red', one more JJ-6 development aircraft.

Shenyang/Tianjin JJ-6 (FT-6) advanced trainer (product 48)

Since the *Farmer* made up the backbone of the PLAAF's fighter element, a supersonic trainer was urgently required; the subsonic JJ-5 was not entirely adequate for training J-6 pilots, to say nothing of the JJ-2. Hence in October 1966 China's Ministry of Aircraft Industry formulated, rather belatedly, an operational requirement for a two-seat trainer version of the J-6 capable of matching the performance of the single-seater. Logically, this aircraft received the designation JJ-6.

These views show the production JJ-6's brake parachute fairing and triple ventral fins.

JJ-6s '41052 Red' and '41053 Red' share the flight line with three J-6Bs.

FT-6 '10828' was operated by the Pakistan Air Force's 16 Sqn 'Panther' at Peshawar.

Like the JJ-5, the new trainer was not a copy because, contrary to allegations by some Western authors, there never was a two-seat MiG-19 to copy it from; the Chinese engineers had to start from scratch. The JJ-6 was developed by the Shenyang design bureau in close co-operation with the Military Aviation Institute.

As on most trainers, on the JJ-6 the trainee and instructor sat in tandem under a common

Another export FT-6, this time an Egyptian aircraft serialled 3953.

canopy; the latter had individual sections hinging open to starboard. The height of the canopy and windshield was increased by 80 mm (3 5/32 in) to give the back-seater a measure of forward view. In order to avoid a reduction in fuel capacity (as had been the case with the

A Bangladesh Air Force FT-6. The serial 10826 is a leftover from the trainer's PAF days.

JJ-5 and UTI-MiG-15) a 0.84-m (2 ft 9 5/64 in) 'plug' was inserted in the fuselage ahead of the wings; thus both cockpits were located ahead of the wing front spar. The ejection seats were the same as used on the single-seat J-6; an intercom and a blind flying hood were provided.

The wing cannons were deleted to make room for additional 150-litre (33 Imp gal) fuel cells in the wing roots; the nose cannon with 100 rounds was retained. To make up for the increased fuselage area ahead of the CG and ensure adequate directional stability, two large outward-canted trapezoidal fins were installed under the aft fuselage, augmenting the standard ventral fin. The mainwheels featured disc brakes instead of expander-tube brakes. The whip aerial of the communications radio was moved to a position aft of the instructor's cockpit on the port side.

Prototype construction began in Shenyang in 1967. Serialled '09 Red' and powered by standard WP-6 engines, the prototype made its first flight on 6th November 1970, piloted by Wang Chunyou. The aircraft differed from subsequent JJ-6s in having slender cigar-shaped pods on the wingtips; these were probably test instrumentation pods, not fuel tanks.

Comprehensive tests continued until December 1973, whereupon the JJ-6 entered production at two factories – in Shenyang and Tianjin. Production aircraft differed from the prototype in having the brake parachute relocated to a bullet fairing at the base of the fin, as on the J-6C, and in having longer and shallower outer ventral fins (the latter were probably reshaped to prevent damage in a tail-down landing).

The aircraft remained in production for thirteen years; by 1986 a total of 634 trainers had rolled off the production lines. Besides deliveries to the PLAAF, the JJ-6 was exported (mostly to Pakistan) as the FT-6. Pakistani FT-6s were upgraded in much the same way as the single-seaters, including installation of Martin-Baker PKD10 (Mk.10L) zero-zero ejection seats. This, incidentally, created a slight inconvenience; since the Martin-Baker seat pan is located higher than that of the KK-1, the aircraft can only be flown by pilots who, together with the 'bone dome' helmet, are not more than 1.73 m (5 ft 8 in) tall. There are indications that some FT-6s were fitted with missile rails for AIM-9B/L Sidewinder AAMs.

Shenyang J-6 I

The designation J-6 I has been quoted as a parallel designation of the J-6A, but this is now known to be incorrect. The *real* J-6 I was probably the result of an attempt to improve

Close-up of the nose of J-6 I '2996 Red', showing the fixed intake centrebody.

the performance of the basic J-6. The fuselage ahead of the cockpit was redesigned, being slightly 'fatter' (rather in the manner of the MiG-19P/PM), and a small non-adjustable shock cone was added to the intake splitter plate, rather in the nature of the tracking antenna radome on the MiG-19P/PM. This was purely an aerodynamic improvement, not housing any form of radar. The aircraft was armed with two Type 23-2 wing cannons and one Type 30-1 cannon in the nose.

Apparently the modified intake was not working as it should, and the aircraft became a stepping stone in the development of the J-6 II described below. The J-6 I prototype (unidentifiable as the serial has been obliterated) was relegated to the PLAAF Museum in Datangshan. Originally stored with a damaged lower intake lip and a short shock cone (probably non-authentic and hastily replaced after being struck by a vehicle), it was later repaired as '2996 Red' and given a longer and more pointed shock cone.

Shenyang J-6 II tactical fighter

In the mid-1960s the basic J-6's top speed of 1,450 km/h (901 mph) was considered inadequate. The engineers at the Shenyang aircraft factory set to work refining the fighter, and the result was known as the J-6 II.

The aircraft was evolved from the J-6 I prototype. The main recognition feature was again a fairly large and very pointed shock cone in the air intake. This immediately led to speculations that the J-6 II was equipped with a fire control radar but, in fact, the cone was again a purely aerodynamic refinement intended to improve operating conditions for the engines. Unlike the J-6 I, the cone was adjustable and four spring-loaded blow-in doors were added on each side of the nose immediately aft of the air intake lip. Also, the intake splitter was cut back drastically, resulting in a very concave leading edge with the upper and lower halves set at about 30° to the vertical. Finally, the armament was reduced to two cannons under the nose – one Type 30-1 on the starboard side and one Type 23-2 on the port side).

J-6 II '81694 Red' shows off the cut-back intake splitter, smaller adjustable centrebody and auxiliary inlet doors.

The J-6 II prototype ('40404 Red'?) made its first flight on 25th March 1969. This aircraft is now on display at the Datangshan museum together with a second example, '40403 Red'.

'40404 Red', the J-6 II prototype, in 'tiger' camouflage at the PLAAF Museum.

J-6 III '11323 Red' on display at the PLAAF Museum.

J-6 III '51209 Red' (c/n *Jian* 6-4947), one of two at Datangshan, shows the wingtip launch rails for PL-2 AAMs.

Shenyang J-6 III (J-6 Xin?) tactical fighter

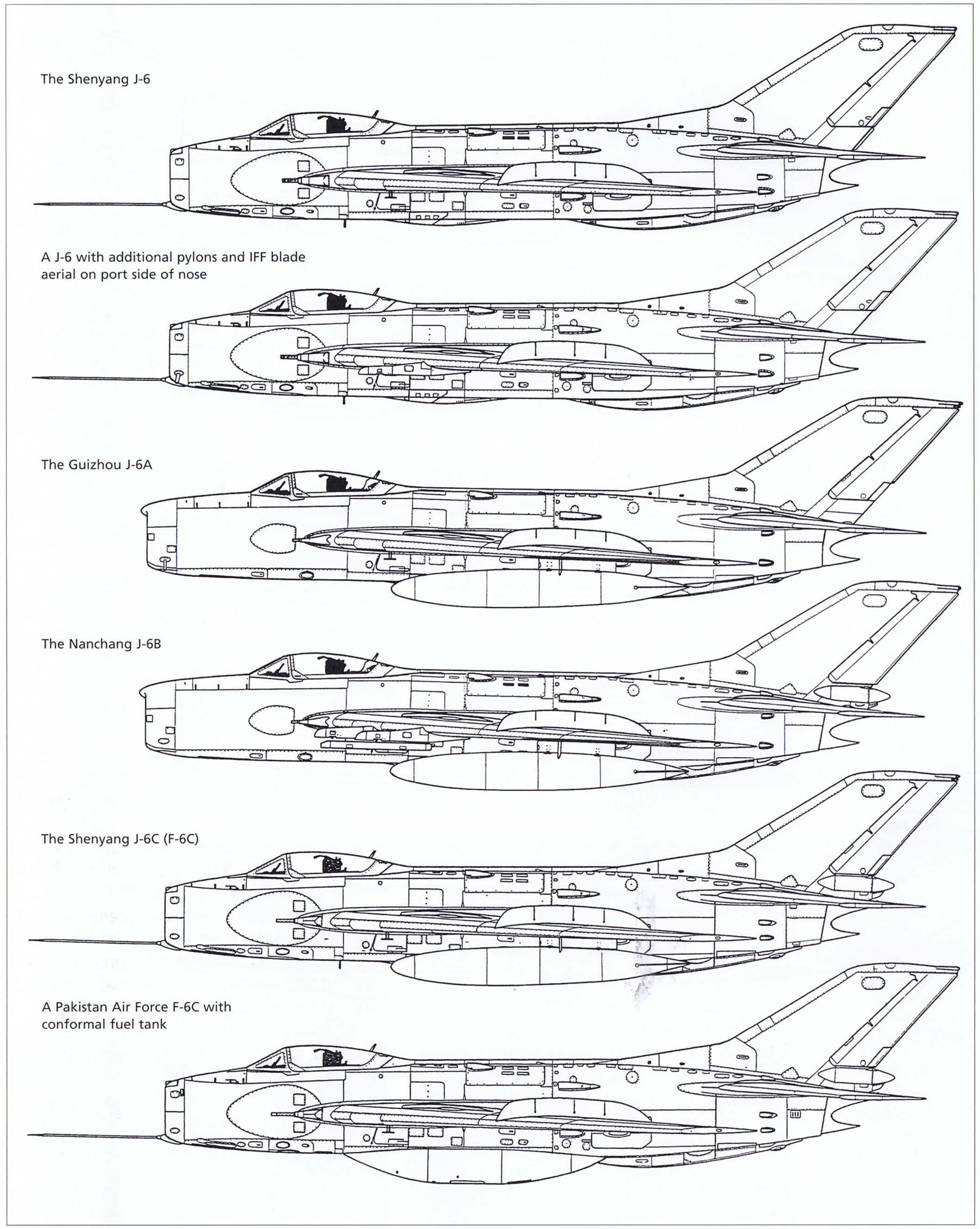
This was a further development of the J-6 II. This aircraft has often been referred to as the J-6 Xin ('new J-6'), but some sources dismiss this designation as inaccurate.

As compared to the J-6 II, the wing span was reduced and the wing chord increased to compensate for this; flap and aileron area was increased accordingly. Launch rails for PL-2 AAMs were fitted to the wingtips – for the first time on a Chinese fighter. The two independent hydraulic systems were replaced by a simpler and lighter common system. The J-6 III was powered by uprated WP-6A engines. The armament consisted of three Type 30-1 cannons without muzzle brakes. Finally, the brake parachute was installed at the base of the fin, as on the J-6B/C.

Typically of the 'Cultural Revolution' period, the work progressed quickly. The prototype ('11323 Red'?) entered flight test on 6th August 1969. Tests showed that the J-6 III was faster and more agile than the basic *Farmer-C* at medium altitude; the exact top speed attained is not known but may be surmised as around 1,600-1,800 km/h (994-1,118 mph).

The aircraft was promptly put into production without certification and several hundred were built. However, this decision was premature; the J-6 III became an operational nightmare. All the aircraft had to be returned to the manufacturer for modifications. Over a four-year period, Shenyang made numerous – costly – improvements (in particular, the air intake design was revised and the original hydraulic system which was more reliable, was reinstated. Still, the J-6 III never came up to scratch.

'20158 Red', a J-6 IV at the PLAAF Museum, shows off the reprofiled nose radomes.

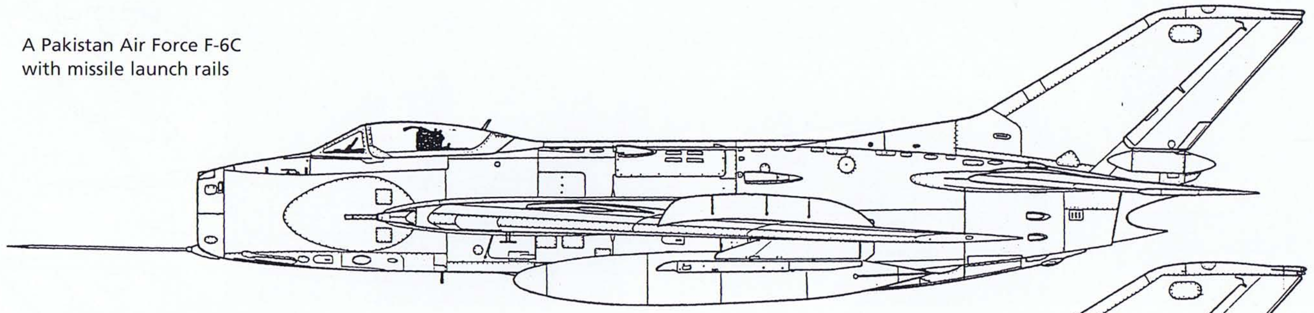


Guizhou J-6 IV interceptor

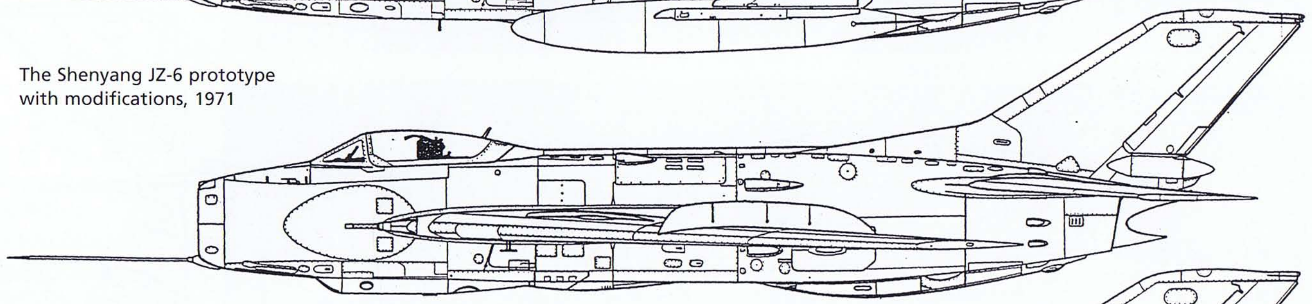
In 1974 the Guizhou Aircraft Factory made an attempt to improve the production J-6 II (J-6B) all-weather interceptor. The resulting aircraft was known as the J-6 IV.

The shape of the nose was altered signifi-

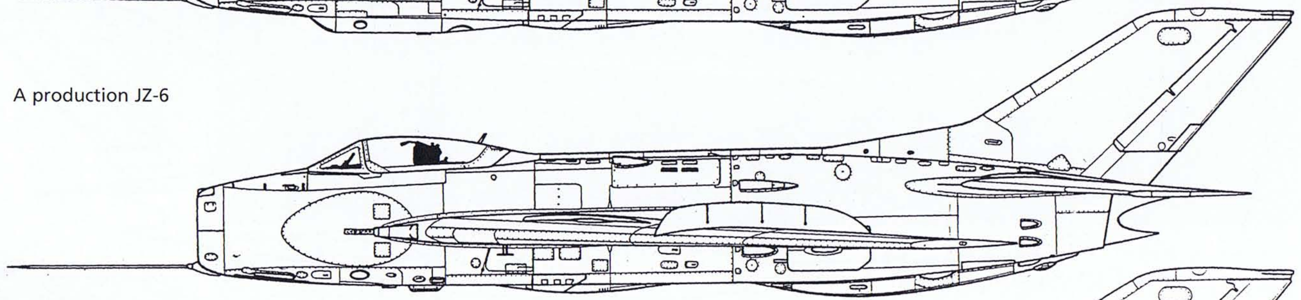
A Pakistan Air Force F-6C with missile launch rails



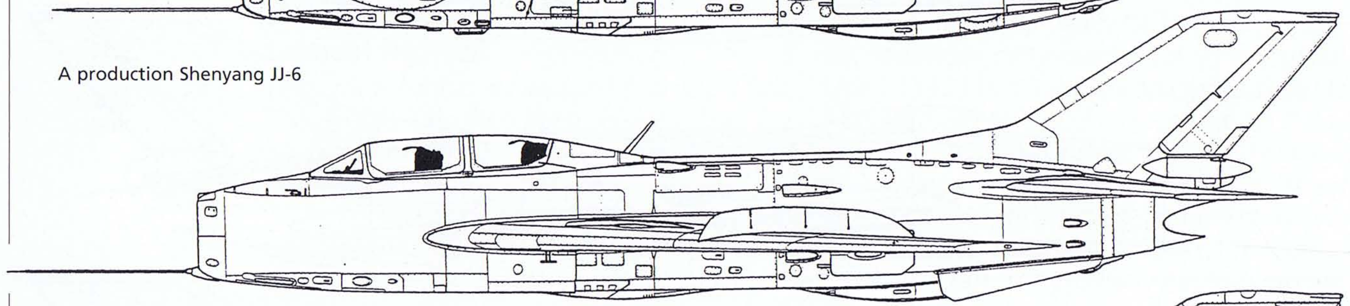
The Shenyang JZ-6 prototype with modifications, 1971



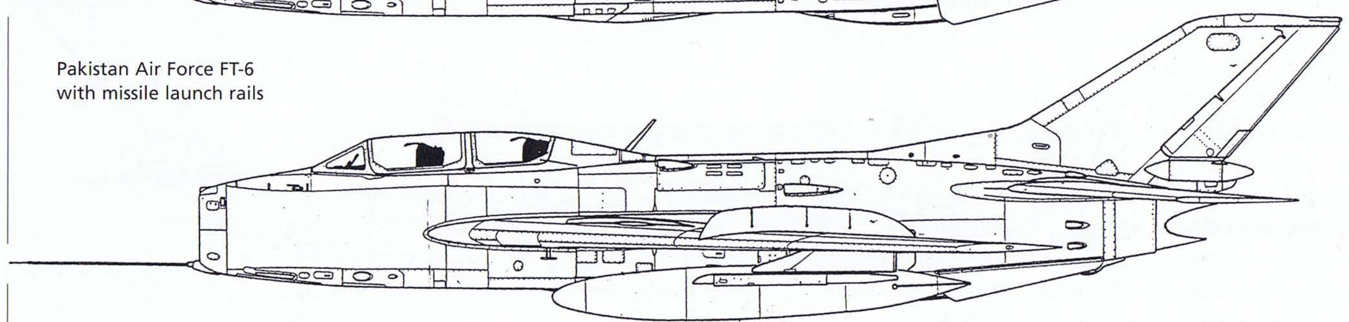
A production JZ-6



A production Shenyang JJ-6



Pakistan Air Force FT-6 with missile launch rails

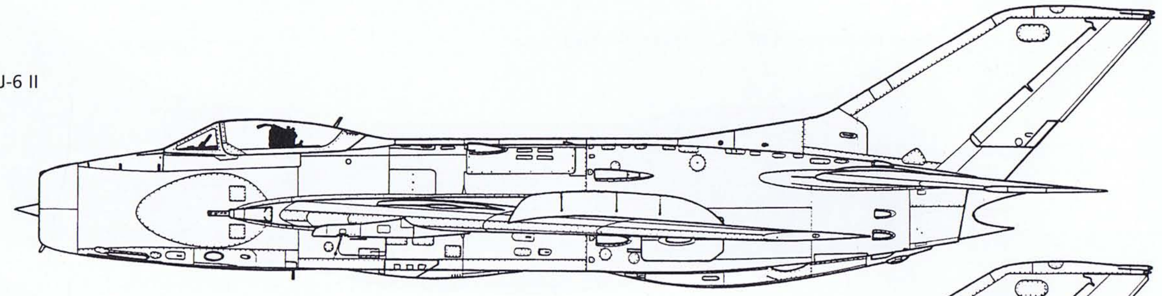


cantly in order to improve the fighter's aerodynamics. The air intake had a sharp lip (the structure was redesigned to maximise inlet duct cross-section). The upper 'fat lip' tracking antenna radome was likewise sharpened and extended forward, while the standard centre-body radome of the J-6 II having a double curvature gave way to a perfectly conical blunt radome. A flatter low-drag canopy was also fitted. .

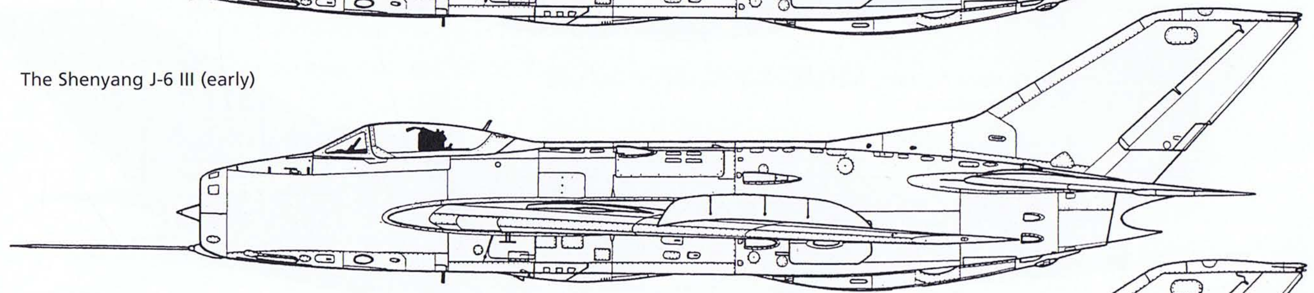
Much attention was given to improving the aircraft's field performance; the engineers had benefited from Vietnam War experience where Vietnamese fighters often had to operate from short 'ambush strips'. Hence provisions were made for jet-assisted take-off (JATO) bottles, disc brakes were fitted to the mainwheels and the brake parachute container was moved to the base of the fin *à la* J-6C. Finally, the engine starting system was improved, as was the radar homing and warning system.

In addition to two long-barrelled Type 23-2 cannons the J-6 IV was armed with two PL-2 AAMs carried on pylons outboard of the drop

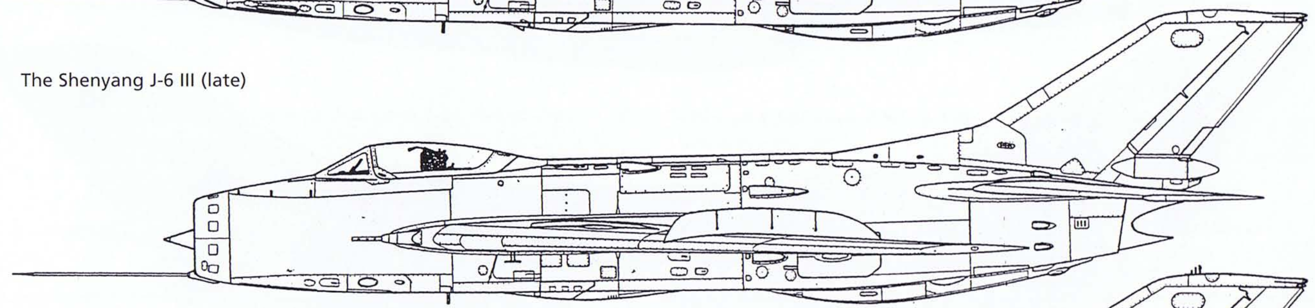
The Shenyang J-6 II



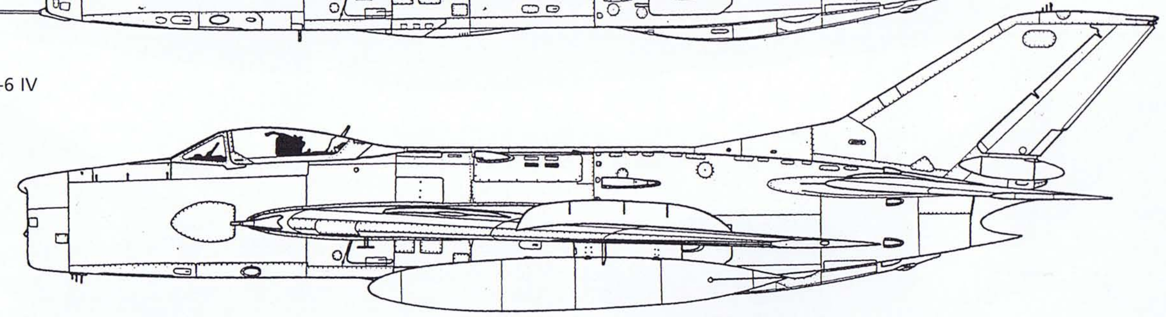
The Shenyang J-6 III (early)



The Shenyang J-6 III (late)



The Guizhou J-6 IV



tanks. Chinese sources indicate that a new, indigenous radar was fitted.

Painted white overall and serialled '20158 Red', the J-6 IV prototype (c/n #6-4702) made its first flight on 24th September 1970; this aircraft is now preserved at the Datangshan museum. After a protracted period of tests type entered small-scale production and became operational with the PLAAF in 1977; production continued at Guizhou until the early 1980s.

Shenyang/Tianjin JJ-6 ejection seat testbed

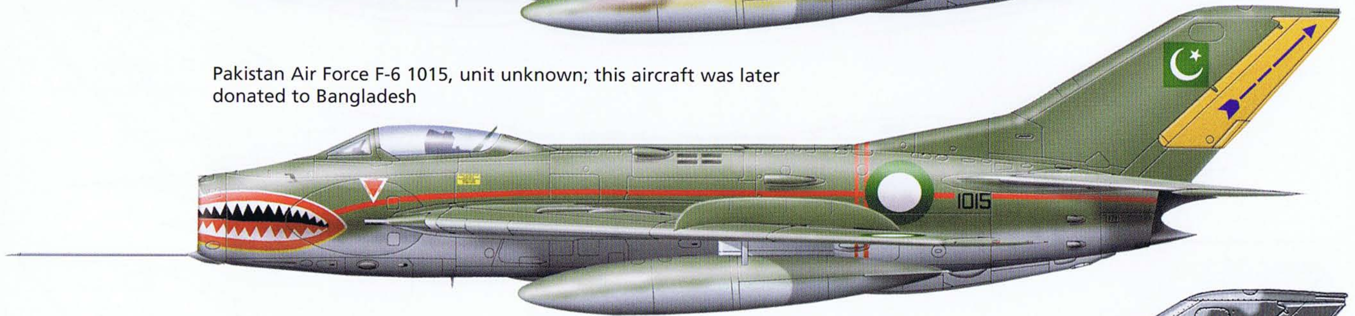
At least one production JJ-6 trainer serialled '009 Red' was converted into a testbed for indigenous ejection seats. The experimental

'009 Red', the JJ-6 modified as an ejection seat testbed, in action.

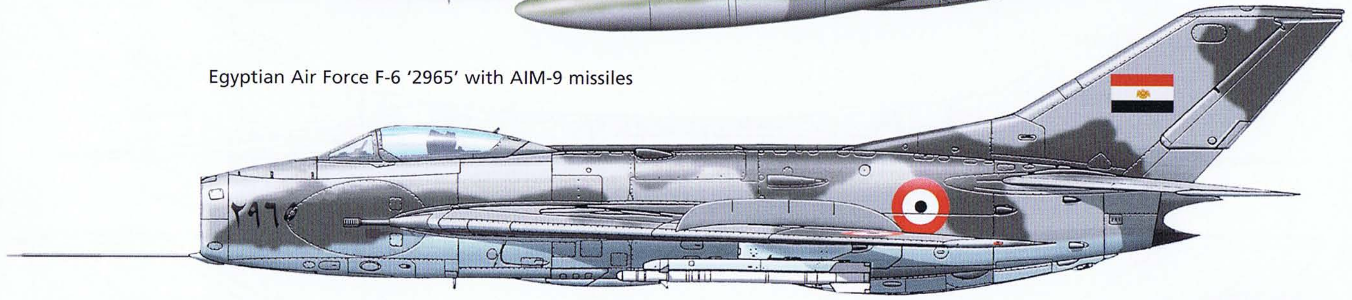
'008 Red', the BW-1 fly-by-wire control system testbed based on the JJ-6.

Pakistan Air Force F-6 47-1423, unit unknown

Pakistan Air Force F-6 1015, unit unknown; this aircraft was later donated to Bangladesh



Egyptian Air Force F-6 '2965' with AIM-9 missiles



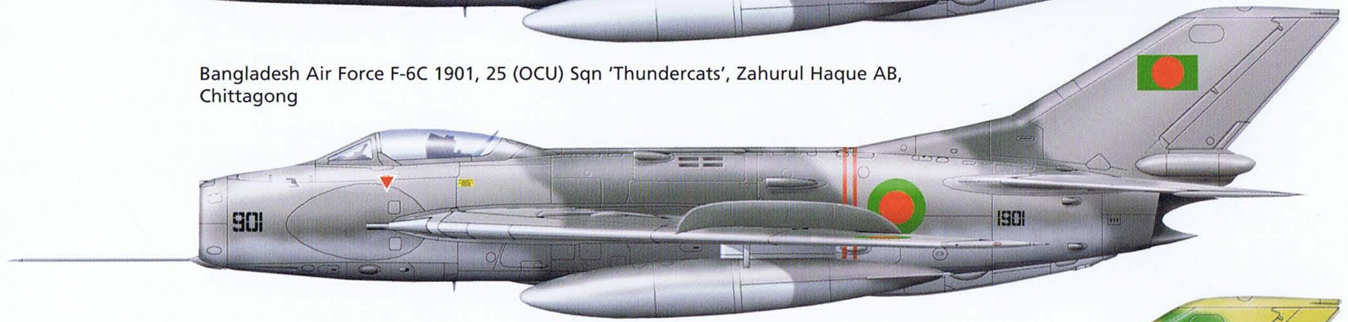
PLAAF J-6C '4465 Red' with quick-identification tail markings

Pakistan Air Force F-6C 10426, No. 26 Sqn 'Black Spiders', Peshawar

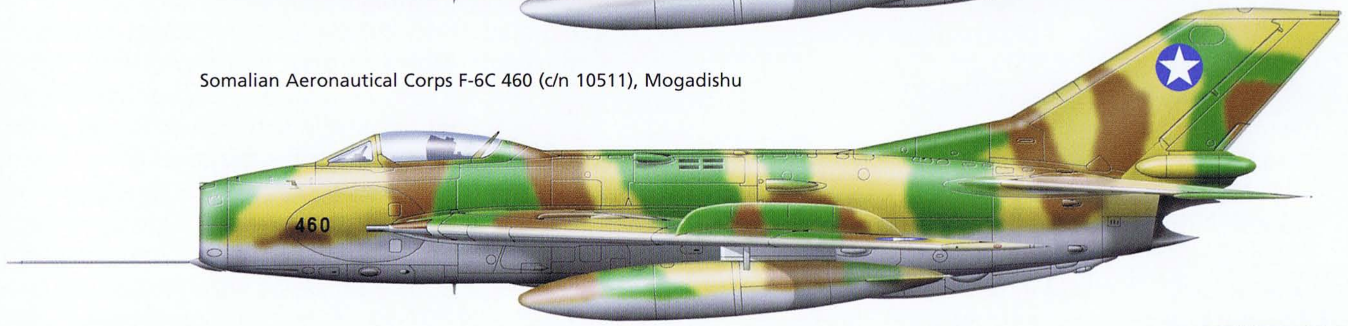
Pakistan Air Force F-6C 10434 in a farewell colour scheme marking the type's withdrawal from PAF service in 2002

PLAAF J-6B '6509 Red'

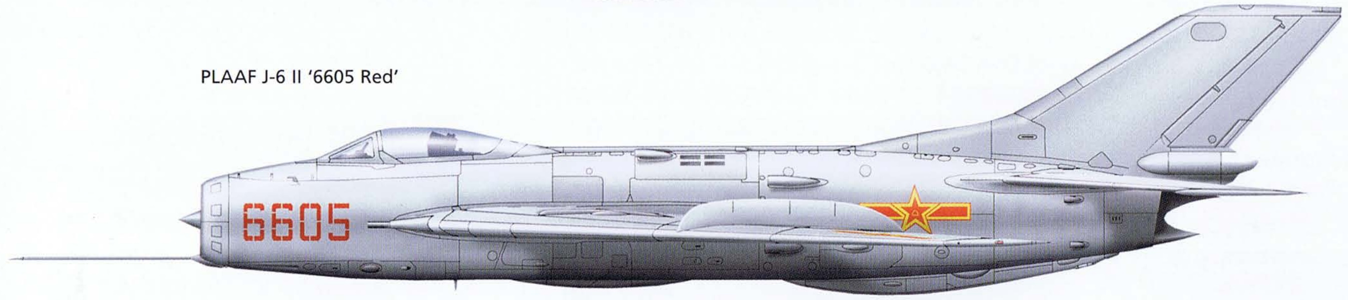
Bangladesh Air Force F-6C 1901, 25 (OCU) Sqn 'Thundercats', Zahurul Haque AB, Chittagong



Somalian Aeronautical Corps F-6C 460 (c/n 10511), Mogadishu



PLAAF J-6 II '6605 Red'



PLAAF JJ-6 '44635 Red', 42nd Division, Guilin-Liangjiang AB

Pakistan Air Force FT-6 10111, No. 25 Sqn (OCU), Sargodha AB

Specifications of the J-6 family

	J-6	J-6A	J-6B	J-6C	JJ-6
Powerplant	WP-6	WP-6	WP-6	WP-6	WP-6
Thrust, kgp (lbst):					
dry	2,600 (5,730)	2,600 (5,730)	2,600 (5,730)	2,600 (5,730)	2,600 (5,730)
reheat	3,250 (7,160)	3,250 (7,160)	3,250 (7,160)	3,250 (7,160)	3,250 (7,160)
Wingspan	9.00 m (29 ft 6 21/64 in)	9.00 m (29 ft 6 21/64 in)	9.00 m (29 ft 6 21/64 in)	9.00 m (29 ft 6 21/64 in)	9.00 m (29 ft 6 21/64 in)
Length:					
less pitot	12.54 m (41 ft 1 45/64 in)	13.025 m (42 ft 8 51/64 in)	13.025 m (42 ft 8 51/64 in)	12.54 m (41 ft 1 45/64 in)	13.44 m (44 ft 1 1/8 in)
with pitot	14.64 m (48 ft 0 3/8 in)	–	–	14.64 m (48 ft 0 3/8 in)	15.74 m (51 ft 7 11/16 in)
Height on ground	3.885 m (12 ft 8 61/64 in)	3.885 m (12 ft 8 61/64 in)	3.885 m (12 ft 8 61/64 in)	3.885 m (12 ft 8 61/64 in)	3.885 m (12 ft 8 61/64 in)
Wing area, m^2 (sq ft)	25.16 (270.53)	25.16 (270.53)	25.16 (270.53)	25.16 (270.53)	25.16 (270.53)
Empty weight, kg (lb)	5,172-5,447 (11,402-12,008) †	n.a.	5,660 (12,477)	5,760 (12,698)	
TOW, kg (lb):					
normal (in 'clean' condition)	7,560 (16,670)	7,730 (17,040)	7,880 (17,370)	7,545 (16,630)	n.a.
maximum (with drop tanks)	8,662 (19,096)	9,100 (20,060)	9,400 (20,720)	8,932 (19,691)	n.a.
in overload config. (w. tanks & FFAR pods)	8,832 (19,470)	n.a.	n.a.	n.a.	8,932 (19,691)
Fuel load, kg (lb):					
internal	1,735-1,800 (3,825-3,968) †	n.a.	n.a.	1,687 (3,719)	n.a.
with drop tanks	2,796 (6,164)	3,675 (8,101) ‡	n.a.	n.a.	n.a.
Top speed at 10,000 m (32,810 ft), km/h (mph)	1,452 (901.8)	1,432-1,445 (889-897) †	1,230 (764)	1,540 (956)*	1,450 (900)*
Service ceiling, m (ft):					
at full military power	15,600 (51,180)	n/a	n/a	n.a.	n.a.
in full afterburner	17,500-17,900 (57,410-58,730)	17,250 (56,590)	16,600 (54,460)	17,900 (58,730)	17,900 (58,730)
Range, km (miles):					
in 'clean' condition	1,400 (869)	1,100 (683)	n/a	1,390 (863)	940 (583)
with drop tanks	2,200 (1,366)	1,800-1,910 (1,118-1,186) †	1,800-1,910 (973-1,032) †	2,200 (1,189)	
Endurance:					
in 'clean' condition	1 hr 43 min	n.a.	n.a.	n.a.	n.a.
with drop tanks	2 hrs 38 min	2 hrs 18 min	n.a.	n.a.	n.a.
Take-off run, m (ft):					
with drop tanks at full mil power	900 (2,960)	n.a.	n.a.	670 (2,200)	670 (2,200)
in 'clean' condition in full afterburner	515 (1,690)	n.a.	n.a.	n.a.	n.a.
Landing run, m (ft):					
w. brake parachute	610 (2,000)	n.a.	n.a.	600 (1,970)	600 (1,970)
without brake 'chute	890 (2,920)	n.a.	n.a.	n.a.	n.a.

* At 11,000 m (36,089 ft) † Data vary according to source ‡ With 760-litre (167.2 Imp gal) drop tanks

seat was fired from the rear cockpit, which had a suitably modified canopy.

BW-1 control system testbed

Another JJ-6 serialled '808 Red' became a testbed for the KF-1 fly-by-wire control system developed for the Xian JH-7 (FBC-1 Flying Leopard) fighter-bomber. The conversion was undertaken by the Xian Aircraft Co.; the aircraft was designated BW-1.

Shenyang Dongfeng-104 fighter (project)

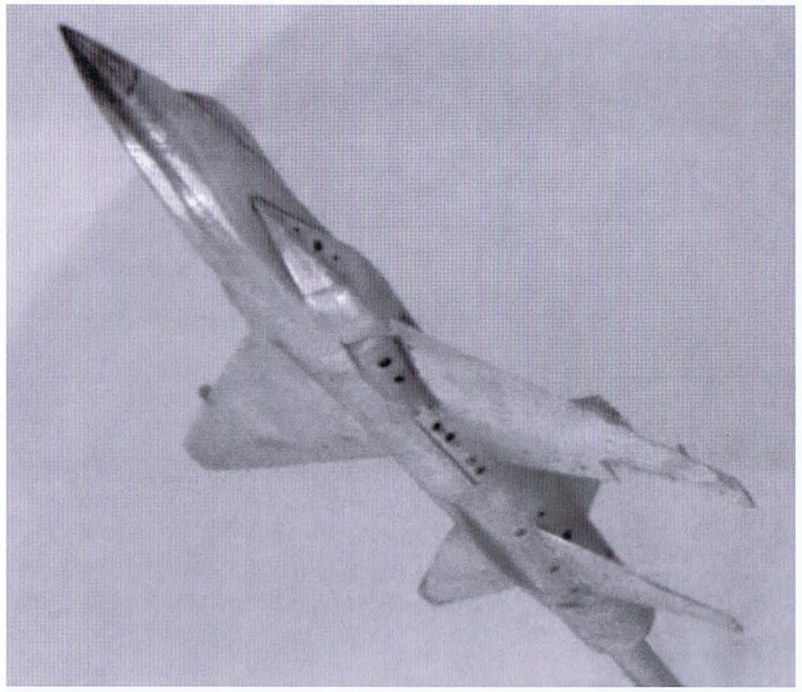
In the late 1950s the design department of the Shenyang Aircraft Factory started developing projects of fighters that were no longer copies of Soviet designs. Continuing the original manufacturer's designation series of the locally built MiG-19 versions, these were designated Dongfeng. The first of these projects was the Dongfeng-104 (DF-104). Regrettably nothing is known about this aircraft, save that it was developed with Soviet assistance. There have been suggestions that the DF-104 was to have two WP-6 turbojets.

Shenyang Dongfeng-107 fighter (project)

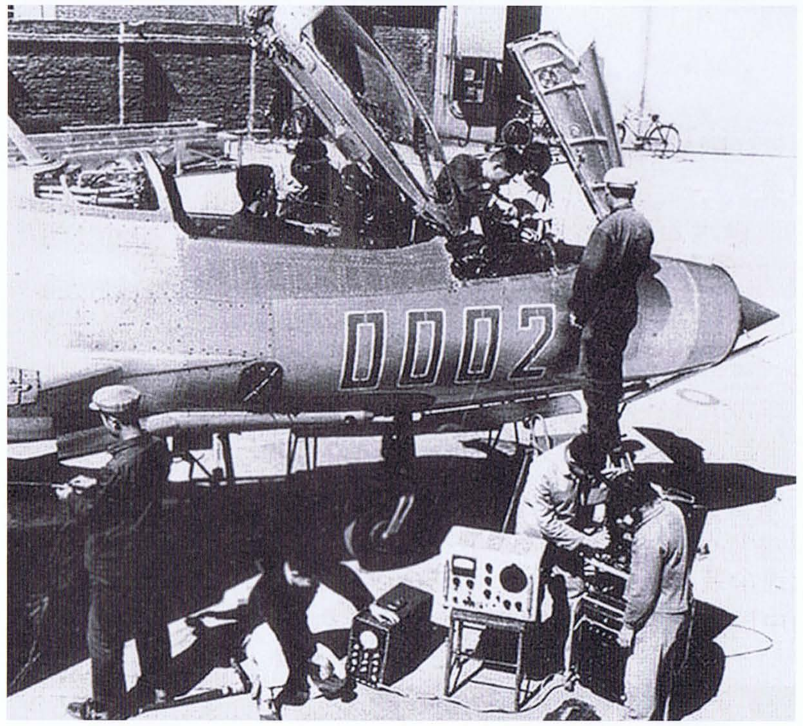
The Dongfeng-107 (DF-107) was designed to meet a requirement for an all-weather tactical fighter with a top speed of Mach 1.8 and a service ceiling of 20,000 m (65,620 ft).

Three versions known as DF-107S, DF-107Z and DF-107J were envisaged; the second and third were probably reconnaissance and trainer versions. The twin-engined aircraft bore a certain resemblance to the Northrop F-5 Freedom Fighter, featuring a pointed drooped nose, a cockpit with an aft-opening canopy faired into the fuselage top, low-set wings and two axial-flow turbojet engines breathing through small lateral air intakes just aft of the cockpit. However, the wings had a cropped-delta planform and boundary layer fences, and the tail unit had a totally different shape, featuring a sharply swept fin with a large root fillet and low-set stabilators. The wings were to have variable incidence – an unusual feature. A fire control radar was to be accommodated in the nose. The engines, known as Hongqi-2 (Red Flag-2), were developed by the Shenyang Aero-engine Design Office (SADO) and offered 50% more thrust than the production WP-6.

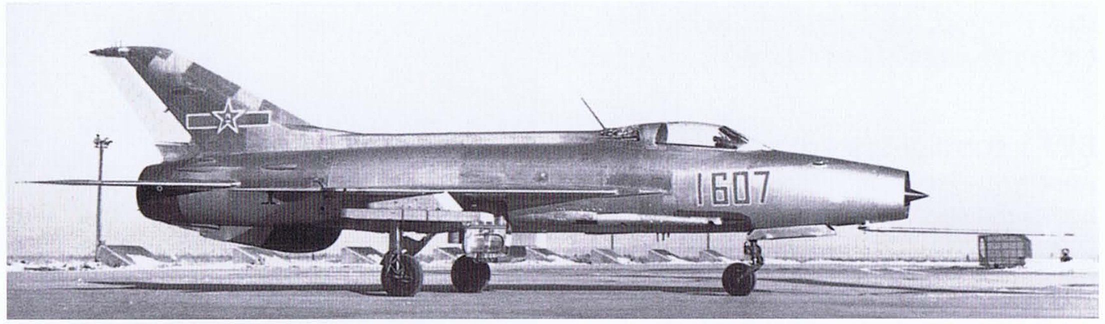
Development work began in 1958, and the first metal on the prototype was cut in May 1959. The very next month, however, the project underwent a massive redesign. Eventually the work on the Hongqi-2 turbojet was terminated by government order in favour of the Type 841 turbojet in November 1959, and that spelled the end of the DF-107, leaving it without a powerplant.



A wind tunnel model of the projected Dongfeng-113 (DF-113) fighter.



'0002 Red' was apparently the second Shenyang J-7. Here the fighter undergoes an avionics check.



'1607 Red', an initial production J-7 with a ventrally located brake parachute and no bulge at the base of the fin.

These J-7s of the PLAAF's 42nd Division are supposedly on QRA duty, but the ground covers over the auxiliary blow-in doors reveal that this is a publicity photo.

HMEA Dongfeng-113 fighter (project)

In contrast, the Dongfeng-113 (DF-113) project was developed by the Harbin Military Engineering Academy. This projected fighter remotely resembled the Lockheed F-104 Starfighter, featuring a slender, area-ruled fuselage with a sharply pointed nose and semi-circular lateral air intakes with half-cone centrebodies. The shape of the cockpit canopy, too, was similar. However, the mid-set wings had a cropped-delta planform and the DF-113 had a conventional tail unit. The DF-113 was to reach a top speed of Mach 2.5 and a service ceiling of 25,000 m (82,020 ft).

Again, development work started in 1958 and prototype construction got under way in 1960. Yet the programme was terminated because certain critical design issues, such as thermal stability of the airframe in lengthy and strong kinetic heating conditions, had not been sufficiently explored in China.

One of the Albanian Air Force's 12 F-7As (c/n 0209) in front of a hardened aircraft shelter at Rinas AB.

J-7 fighter family

The next fighter to enter large-scale production in China was the famous MiG-21 (NATO reporting name *Fishbed*) – a single-engined light fighter utilising a tailed-delta layout with mid-set wings and conventional tail surfaces. The MiG-21 had first flown in 1955, and the type entered service with the Soviet Air Force in 1958, spawning a multitude of versions. Typically of the Chinese aircraft industry, new versions were developed that had no Soviet equivalent.

The licence-built MiG-21 and its family of indigenous versions became the most prolific aircraft to be produced in China. Curiously, the Chinese versions were almost as numerous as the Soviet ones but, unlike the latter, were derived almost exclusively from the original Ye-6 (MiG-21F and MiG-21F-13), not the 'big nose, big tail, big spine' Ye-7 that served as the basis for most of the Soviet variants.

Shenyang J-7 tactical fighter (Type 62)

In early 1961 the Soviet Union granted China licence manufacturing rights for the MiG-21F-13 tactical fighter and its Tumanskiy R11F-300 afterburning turbojet. In keeping with the licensing agreement three *Fishbed-Cs* were delivered to China as pattern aircraft, along with CKD kits for an initial batch of 20 fighters. Before the technology could be transferred in full, however, the rift between Moscow and Beijing occurred, and all co-operation in defence matters was broken off. Having an incomplete set of manufacturing documents, the Chinese nevertheless decided to launch MiG-21 production no matter what.

The new Chengdu Aircraft Factory in Sichuan Province was selected to produce the MiG-21F. The aircraft received the local designation Type 62 (later changed to J-7). In early 1964 the Guizhou Aircraft Factory (now called GAIGC) located in Kwangtung Province started manufacturing J-7 airframe components, which were delivered to Chengdu for final assembly. Meanwhile, the Guizhou Engine Factory (now called LMC – Liyang Motor Corp.) was gearing up to produce the R11F-300 engine; the licence-built version was designated WP-7. Typically of a new product, production entry was beset by quality problems, and the 5,100-kgp (11,240-lbst) WP-7 initially had a time between overhauls of just 100 hours. The J-7 was armed with Type 30-1 cannons and PL-2 AAMs.

When Soviet technical assistance was cut off, it became clear that the commissioning of the Chengdu Aircraft Factory would be delayed. Since the People's PLAAF urgently needed the new fighter, J-7 production was temporarily transferred to the Shenyang Aircraft Factory.

Mastering production of such a complex aircraft proved to be quite a challenge. A static test airframe of entirely Chinese manufacture completed its test cycle in November 1965. On 17th January 1966 the first Shenyang-built J-7 made its maiden flight at the hands of Ge Wenrong. In the course of the tests the fighter attained a top speed of Mach 2.02. Yet the type's production career at Shenyang was brief due to the 'Cultural Revolution'; the factory managed to complete only a dozen J-7s *sans suffixe*. These aircraft were almost identical to the Soviet-built MiG-21F-13; the main differences lay in the temporary lack of missile armament and the fixed air intake centrebody (the Chinese had not received the part of the manufacturing documents concerned with the movable centrebody).

Chengdu F-7A tactical fighter

Apart from deliveries to the PLAAF, the Chengdu-built initial production version of the J-7 *sans suffixe* was exported to Albania and Tanzania. The export version was designated F-7A. Like the early PLAAF J-7s, these aircraft lacked the port cannon and had a ventral brake parachute housing.

'98071 Red' displayed at the PLAAF Museum is a modified J-7 *sans suffixe* with the new dorsal brake parachute housing but only one cannon.

Chengdu J-7 (modified) tactical fighter

When the Chengdu Aircraft Factory was finally commissioned, J-7 production was assigned to this factory, allowing the Shenyang Aircraft Factory to concentrate on the J-8 fighter. The first J-7s rolled off the Chengdu production line in June 1967. These featured a number of improvements. Some examples were identifiable by a slight bulge at the fin/fuselage junction apparently housing some new equipment. Others had the brake parachute relocated to a cylindrical container at the base of the rudder. This arrangement had been introduced on Soviet versions from the MiG-21PFS onwards; the Chinese designers were apparently aware of this. Nevertheless, the fighter retained the original forward-hinged canopy and single cannon.

The modified fighter was built in small numbers, seeing limited service with the PLAAF. When the PL-2 missile became available, it was issued to J-7 units.

J-7 I '9957 Red' was one of several development aircraft with a bulkier canopy necessitated by the installation of the indigenous Type 2 ejection seat. It is seen here preserved at the National Defence park in Beijing

Chengdu J-7 I tactical fighter

Since the efforts to copy the K-13 AAM as the PL-2 were taking longer than anticipated, the

Six PLAAF 33rd Division/98th or 99th Regiment J-7 IIs on QRA duty at Chongqing-Baishiyi AB.

Some of the development aircraft owned by the Chengdu Aircraft Corp. had unusual serials prefixed CAC. This is CAC 0134 – probably the first prototype of the F-7 II (the J-7 II's export version).

Chinese decided to bolster the J-7's armament by reverting to the MiG-21F's original twin-cannon arrangement, reinstating the port Type 30-1 cannon. Also, a variable air intake with a translating shock cone was introduced at last. Like the upgraded J-7 *sans suffixe* described above, the new version had a brake parachute container at the base of the rudder but retained the standard canopy and the original WP-7 engine. This time the changes were deemed sufficient to warrant a new designation, J-7 I.

The production rate remained low and the new fighter was delivered to the PLAAF in very limited numbers. The Chinese iteration of the MiG-21F's crew escape system where the canopy doubled as a slipstream shield during ejection proved extremely troublesome. The Mikoyan OKB had encountered similar problems with the system, but here they were compounded by problems associated with reverse-engineering the aircraft.

The J-7 I's service entry with the PLAAF coincided with the outbreak of the Vietnam War. Unlike the Shenyang F-5 (J-5) and F-6 (J-6), the new supersonic fighter missed its chance to fight in Vietnam due to the type's teething troubles and the limited number available. Yet the J-7 I did indeed receive its baptism of fire during the Vietnam War. Between 1969 and 1971 the PLAAF J-7 I interceptors defending China's southern borders destroyed six USAF combat aircraft intruding into Chinese airspace.

The J-7 I only saw very limited service with the PLAAF and the PLANAF due to poor manufacturing quality, design flaws and unsatisfactory performance.

Chengdu J-7 I (modified) tactical fighter

In an attempt to address the problem of the unsatisfactory crew rescue system the Chengdu Aircraft Factory modified at least two J-7 Is serialled '3487 Red' and '9957 Red'. These were fitted with the indigenous Type 2 cartridge-fired seat permitting safe ejection at lower altitudes within a speed range of 250-850 km/h (155-527 mph); in a later version the minimum safe ejection speed was reduced to 130 km/h (81 mph). The seat had a bulkier headrest that was too large to fit inside the standard canopy. Hence a new canopy with a taller rear frame to accommodate the seat was fitted. Both aircraft had twin cannons.

Yet the PLAAF did not want to keep the forward-hinged canopy/slipstream shield, no matter what type of seat was inside. Hence the designers at Chengdu had to develop a new canopy offering higher safety during ejection.

Chengdu J-7 II tactical fighter

In 1974 the Chengdu Aircraft Factory began development of a further refined version designated J-7 II. Its most obvious external identification feature was the new cockpit canopy optimised for the Type 2 ejection seat. The strongly convex canopy consisted of a fixed windshield and a hinged rear portion. Unlike the late MiG-21 versions, the rear canopy portion was hinged at the rear, not to starboard.

F-7 II '950138 Red' (formerly CAC 0138) on final approach.

Over 300 test ejections demonstrated the new seat's higher capabilities. The Type 2 ejection seat was first used in a real-life emergency in 1984; a year later the designers of the seat were awarded the National Gold Quality Medal in recognition of their work.

The J-7 II was powered by an improved WP-7B turbojet offering a 12.8% higher dry thrust, a 70% higher afterburning thrust – 6,100 kgp (13,450 lbst) versus 5,100 kgp (11,240 lbst) – and a TBO doubled to 200 hours. The aircraft reverted to the fixed-geometry air intake – apparently the Chinese version of the variable intake proved unsatisfactory. A larger drop tank holding 720 litres (158.4 Imp gal) was developed for the J-7 II, replacing the original 480-litre (105.6 Imp gal) model. Changes were also made to the equipment and armament; in particular, the PL-2 AAM became a standard fit at last. Also, the brake parachute container was modified, allowing the parachute to be deployed at higher speed and reducing the landing run to less than 800 m (2,640 ft).

The prototype performed its maiden flight on 30th December 1978 with Yu Mingwen at the controls. The J-7 II became the first member of the J-7 family to be produced in significant numbers, entering PLAAF service in the early 1980s. Yet the production rate remained low; also, even though the PLAAF and the PLANAF were in urgent need of a modern fighter to replace the ageing J-5s and J-6s, foreign customers seemed to enjoy priority. Apparently the Chinese defence industry was eager to earn hard currency for a technology upgrade.

Chengdu F-7B tactical fighter

Work on the export version of the J-7 II, known as the F-7B, started in 1979. The fighter's two wing pylons were re-wired to permit carriage of the French Matra R.550 Magic IR-homing short-range AAM, which was also reverse-engineered and built in China as the PL-7. The Egyptian Air Force was the launch customer; Egypt and Iraq reportedly took delivery of 90 F-7Bs each in 1982-83 (however, photo evidence suggests that the Iraqi aircraft were F-7Ms, not Bs). Later, the Sudanese Air Force ordered 15 F-7Bs (the Sudanese contract was completed in 1996).

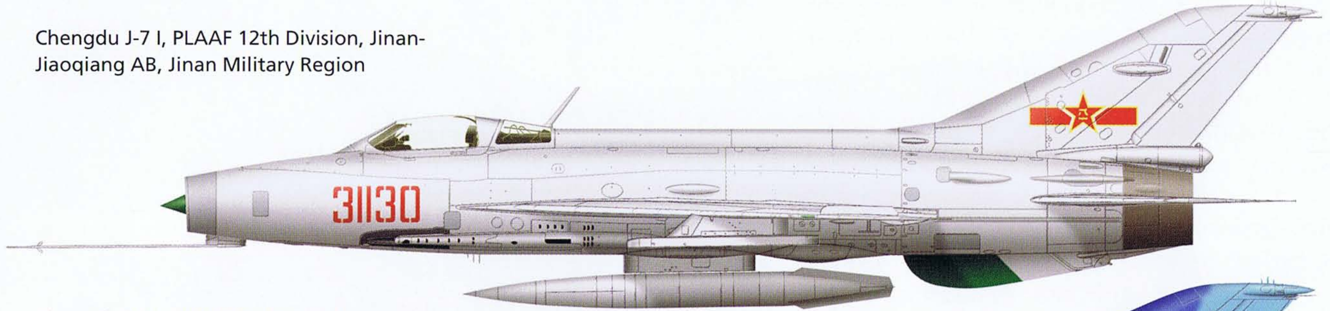
Chengdu F-7 II development aircraft

At least two J-7 IIs wearing 'CAC F-7II' titles and the demonstrator serials CAC 0134 and CAC 0138 were used by the Chengdu Aircraft Corporation (CAC) as development aircraft. Later CAC 0138 gained the non-standard six-digit serial '950138 Red'; this aircraft and '950137 Red' were apparently operated by one of China's flight test centres. '950137 Red' was unusual in having the pitot boom relocated to the upper side of the nose, a fea-

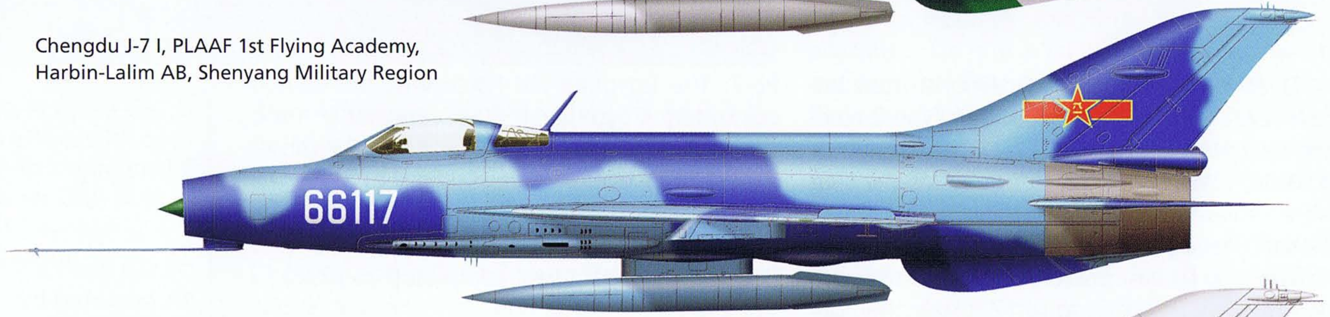
'71169 Red', a J-7 IIA operated by the Flight Test & Training Centre. Note the wide blade aerial and the AoA sensor fairing on the port side of the nose.

This view of CAC 0141 shows the F-7IIA titles and the offset dorsally mounted pitot.

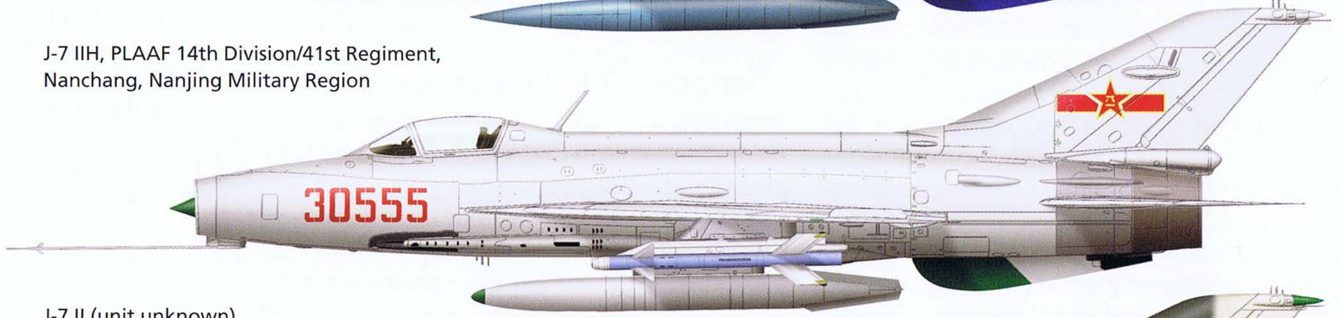
Chengdu J-7 I, PLAAF 12th Division, Jinan-Jiaoqiang AB, Jinan Military Region



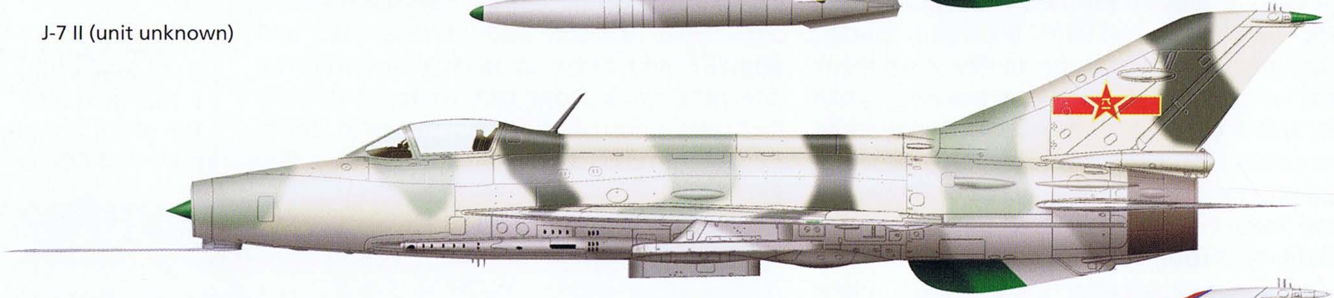
Chengdu J-7 I, PLAAF 1st Flying Academy, Harbin-Lalim AB, Shenyang Military Region



J-7 IIH, PLAAF 14th Division/41st Regiment, Nanchang, Nanjing Military Region



J-7 II (unit unknown)



F-7 II first prototype, Chengdu Aircraft Corp.

ture that became standard on late versions. According to press reports, this aircraft was a stealth technology testbed (presumably used for testing radar-absorbing material coatings).

Chengdu J-7 IIA (F-7 IIA) tactical fighter

Despite the improvements made on the J-7 II, the type no longer met the demands of the day. Therefore in 1984 CAC announced an upgrade programme designated J-7 IIA (alias F-7 IIA). The new variant incorporated quite a few changes. The outward recognition features were the pitot located on the intake's upper lip, offset to starboard, and a small streamlined fairing carrying an angle of attack (AoA) transducer vane on the port side of the nose. The J-7 IIA had a WP-7BM engine, which had the same thrust but was lighter, more

reliable and featured an improved starting system. The cockpit had a stronger birdproof windscreen, a zero-zero ejection seat developed by CAC and an updated instrument layout, adding a British GEC-Marconi Type 956 head-up display/weapons aiming computer (HUD/WAC), which became standard for J-7s from now on. The landing gear was reinforced as well.

The avionics suite now included a GEC-Marconi Type 226 Skyranger radar rangefinder with electronic counter-countermeasures (ECCM) capability, an air data computer, new radios, navaids and IFF transponder. The presence of new radios was revealed by the new broad-chord blade aerial aft of the cockpit. The J-7 IIA was armed with twin Type 30-1 cannons with 60 rpg and could carry the Chinese PL-2 AAM or the Matra Magic.

The improved J-7 IIA (CAC 0141) first flew on 7th March 1984.

CF705, a Chengdu F-7BS delivered to the Sri Lankan Air Force. The Sri Lankan version had two wing hardpoints.

Chengdu F-7BS tactical fighter

Soon CAC began developing sub-variants tailored to the requirements of specific customers. One of these was the F-7BS brought out in 1991 for the Sri Lankan Air Force (hence the S for Sri Lanka); four aircraft were delivered. This fighter retained the less sophisticated Chinese avionics, lacking the HUD.

Chengdu F-7M Airguard tactical fighter

The F-7M Airguard export version represented a major step towards improving the F-7's capabilities and export potential. This version was based on the F-7 IIA. In May 1979 China signed an agreement with GEC-Marconi, which would supply the avionics suite – the HUD/WAC, the Skyranger target ranging radar, the digital mainframe computer, the radio altimeter, the communications suite and the IFF transponder. The new avionics necessitated the installation of a more powerful generator.

The F-7M had an important new feature: two additional wing pylons were fitted outboard of the existing ones; these pylons were 'wet', enabling the carriage of two 480-litre (105.6 Imp gal) drop tanks. The armament included PL-2 and Matra R500 Magic AAMs (built in China as the PL-7).

'84134 Black', one of the prototypes of the F-7M (possibly ex F-7 II CAC 0134), in its original guise. The four wing pylons (note the three drop tanks) and the wide blade aerial are clearly visible.

Trials of the F-7M began in August 1983 and the type was certified in November 1984. The development programme involved a lot of prototypes, including '84134 Black', '86140 Black', '89140 Black', '950140 Red', CAC 0139 and CAC 0141. Export sales commenced in 1985 and the F-7M remained in production until the late 1990s. It was supplied to Bangladesh (see F-7MB), Iran and Myanmar.

Chengdu F-7M avionics testbed

Until the early 2000s, at least one F-7M (identity unknown) was reportedly used by the Chinese Flight Test Establishment (CFTE) as a radar and avionics testbed.

Two F-7MBs of the Bangladesh Air Force's No. 5 Sqn 'Thundercats' demonstrate their ability to carry underwing drop tanks.

A pair of PLAAF 14th Division J-7 IIHs takes off, carrying PL-8 AAMs under the wings.

Chengdu F-7MB tactical fighter

The sixteen F-7Ms delivered to the Bangladesh Air Force were built in a customised configuration designated F-7MB (for Bangladesh), with capability to carry reconnaissance pods.

Chengdu J-7 IIM tactical fighter

This designation applied to PLAAF J-7 IIs upgraded to F-7M standard.

Chengdu J-7 IIH tactical fighter

The J-7 IIH was a J-7 IIA derivative with enhanced ground attack capability (the H stood for *Hongzhaji* – bomber). This was the first version to have versatile weapons adapters/missile rails compatible with all types of ordnance carried by the aircraft. This greatly reduced the time and resources needed during day-to-day operation.

Chengdu F-7P Skybolt tactical fighter

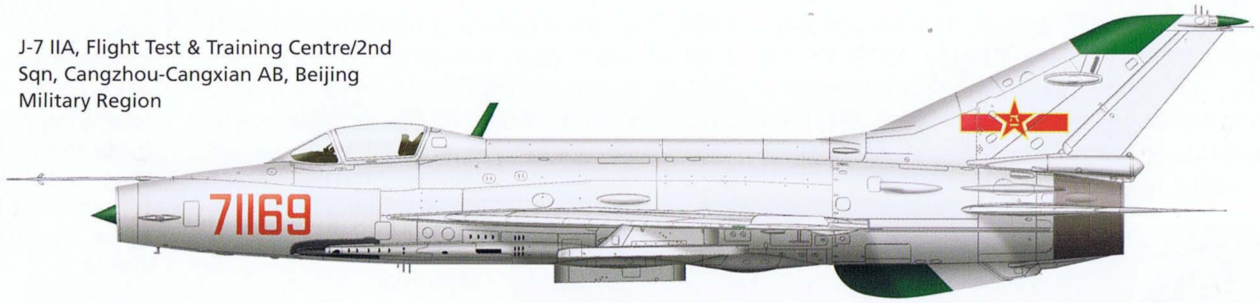
In early 1987 China's strategic ally, Pakistan, began sizing up the F-7M. Two examples were delivered to the Pakistan Air Force (PAF) for evaluation; this included assessment of both air-to-air and air-to-ground performance. The PAF requested that a number of changes be made; these included installation of a Martin-Baker Mk 10L zero-zero ejection seat and the ability to carry four AIM-9P Sidewinder AAMs. The avionics included a GEC Marconi Type 226 Skyranger 7M radar. The resulting version was designated F-7P (for Pakistan) and briefly called Skybolt.

The PAF placed an initial order for 20 F-7Ps and these were delivered in November 1988. A second batch of sixty F-7Ps followed in 1988-89 and another forty in 1993.

Chengdu F-7MP tactical fighter

Soon the PAF became dissatisfied with the F-7P's Skyranger radar that imposed limitations on the fighter's capabilities. Hence the PAF issued requests for proposals to South Africa and Italy for developing a compact, capable and cost-effective replacement radar for the F-7. The choice fell on the Grifo 7 fire control radar developed by the Italian company FIAR (now Galileo). This radar featuring a slot antenna planar array had a detection range in excess of 50 km (31 miles). Additionally, the fighter received US-supplied Rockwell Collins avionics (VOR/ILS receiver, ADF and DME). The cockpit layout was revised accordingly.

J-7 IIA, Flight Test & Training Centre/2nd Sqn, Cangzhou-Cangxian AB, Beijing Military Region



F-7M Airguard prototype, Chengdu Aircraft Corp., 1984

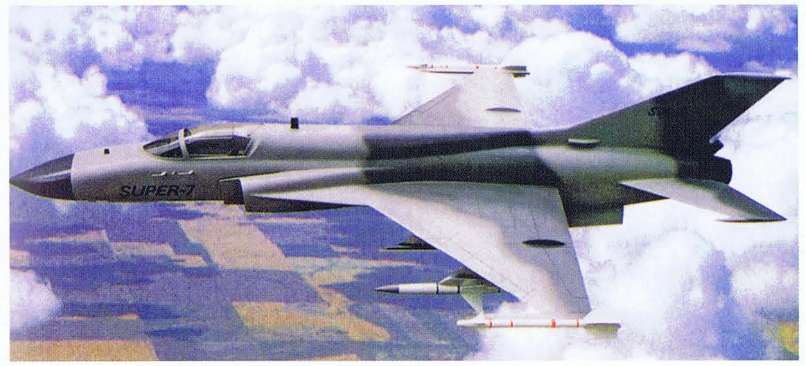
The upgraded aircraft was known as the F-7MP ('modified P'). Flight tests began in May 1996 and were completed in 1997.

Some sources say the F-7MP was eventually upgraded with the improved FIAR Grifo Mk II radar. In comparison to the Grifo 7 the sector of scan was increased from the original ±10° to ±20°. The newer radar also had improved ECM and look-down/shoot-down capability and could track four targets simultaneously.

The F-7P Skybolt prototype combined Pakistan Air Force insignia with China Aviation Technology Industrial Corp. (CATIC) titles and logo. Note the Sidewinder AAMs on the inboard pylons.

Chengdu J-7 IIK tactical fighter (project)

Proceeding from experienced gained with the F-7MP, CAC had plans to upgrade the PLAAF's J-7 IIs to F-7MP/F-7P standard. The resulting configuration was designated J-7 IIK. It is not known if the upgrade was ever implemented.



An artist's impression of the second iteration of the Super 7 project. At this stage only the tail unit bore a resemblance to the J-7; the similarity with the future FC-1 (JF-17) is obvious.

Chengdu Super 7 tactical fighter (project)

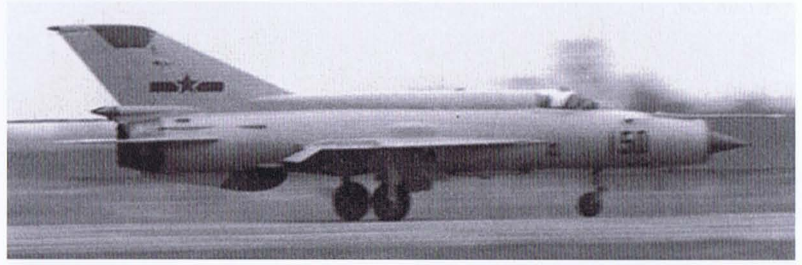
In the mid-1980s the British aircraft industry offered a massive upgrade of the F-7M to improve its performance. Provisionally designated Super-7, the fighter was to feature a modern afterburning turbofan (the General Electric F404-GE-400 or the Pratt & Whitney PW1120) and a new fire control radar. The radar options included the British Ferranti Red Fox (a version of Blue Fox used on the British Aerospace Sea Harrier FRS.1 naval fighter) and the US-made Emerson AN/APG-69.

Although the radar tests were successful, the upgrade was rejected before engine tests could begin. The idea was economically unviable – the radar and the engine each cost more than a new J-7. The name, however, was subsequently reused for the very different Chengdu FC-1 fighter (aka JF-17).

Chengdu J-7 III (J-7C, F-7-3) tactical fighter

In parallel with the development of the F-7M Airguard, in 1981 the Chengdu Aircraft Corp. joined forces with the Guizhou Aircraft Industry Corp., another manufacturer of the J-7/F-7

An artist's impression of the projected J-7CP (the first aircraft to be marketed as the Super 7)



'150 Red', a genuine MiG-21MF obtained from Egypt and tested by the Chinese. The pointed end of the brake parachute housing is the giveaway.

family, to create a true all-weather version of the fighter. The project entered full-scale development in the late 1970s. The aircraft received official designation J-7 III (later renamed J-7C).

This was essentially an attempt to reverse-engineer the Soviet MiG-21SM – or rather its export equivalent, the MiG-21MF. China succeeded in obtaining at least one MiG-21MF from Egypt, which was on friendly terms with both nations, in February 1979. Serialled '150 Red', this fighter became the pattern aircraft for the J-7 III.

The development and production responsibilities were shared between CAC, which was responsible for the fighter's fuselage and final assembly, and GAIC, which would supply the wings and landing gear.

Outwardly the J-7 III was almost identical to the MiG-21MF, featuring the same large air intake with a large dielectric centrebody of pure conical shape, the two-piece cockpit canopy opening to starboard, the fat fuselage spine housing a fuel tank, the broad-chord vertical tail and the ventral cannon installation. The wings featured blown flaps. The brake parachute container, however, was closed by a J-7 I/II style upward-opening hemispherical cover instead of the MiG-21MF's vertically split doors.

The J-7 III was powered by a WP-13 afterburning turbojet equivalent to the Tumanskiy R13-300; the engine was rated at 4,100 kgp (9,040 lbst) dry and 6,600 kg (14,550 lbst) reheat. The WP-13 was reported as an indigenous product jointly developed by the Guizhou Engine Company and the Chengdu Engine Company. As compared to the WP-7, it had substantially higher surge resistance, higher reliability and a longer service life.

Anew HTY-4 zero-zero ejection seat built by CAC was fitted. The canopy featured a rear-view periscope.

The intake centrebody housed a new radar whose development proceeded in parallel with the reverse-engineering effort. Several models were tried, including the Type 317 and Type 317A. The JL-7 pulse-Doppler radar was selected eventually; it could operate both in air-to-air and air-to-ground modes. The maximum detection range was 28 km (17 miles). The SM-8 (HK-03D) optical sight fitted originally was soon replaced by an HK-13A head-up display (HUD).

The armament included a 23-mm (.90 calibre) Type 23-III twin-barrel cannon (a copy of the Gryazev/Shipunov GSh-23L) with 200 rounds. Like the F-7M, the J-7 III had four wing pylons; these were used for carrying four PL-2 or PL-5 IR-homing short-range AAMs, free-fall bombs, or rocket pods with 57-mm, 90-mm or 130-mm FFARs. The outer pylons were 'wet', permitting the carriage of 480-litre drop tanks.

Development began in May 1979 and was completed by May 1980. The first airframe was assembled in February 1984, completing its static testing in April that year. Serialled '151 Red', the first prototype J-7 III performed its maiden flight on 26th April 1984, with Yu Mingwen at the controls; later it became '950151 Red'.

After protracted development the J-7C entered service in 1992. Yet the fighter did not live up to the expectations. It was considerably heavier and less agile than the basic J-7 II; furthermore, the JL-7 radar was unreliable and lacked beyond visual range (BVR) combat and 'look-down/shoot-down' capability which was commonly found on contemporary Western and Russian fighters. Only about 30 examples were built by 1996. The J-7C saw limited service as a dedicated night fighter with the PLAAF's 15th Air Division.

The aircraft was offered for export as the F-7-3; the export model had different missile rails compatible with the Matra R.550 Magic AAMs. No sales have been achieved.

'151 Red' was the first prototype of the J-7 III (aka J-7C), as revealed by the hemispherical brake parachute container cap and the typically Chinese 720-litre drop tank. Here the machine is in the original overall grey air superiority finish and carries four PL-5 AAMs.

The same aircraft at a later date in demonstrator colours.

A production J-7C in two-tone camouflage colours operated by the PLAAF 15th Division.

Chengdu J-7 IIIA (J-7 IV, J-7D, F-7D) tactical fighter

In response to the J-7C's weaknesses, CAC and GAIC began an upgrade programme in the early 1990s. The resulting aircraft was initially known as the J-7 IIIA, later becoming the J-7 IV and ultimately the J-7D. The improvements focused on the avionics: the J-7 IIIA had a revised JL-7A radar, an HK-13A HUD, a JD-3II tactical aircraft navigation (TACAN) system, a Type 563B inertial navigation system and so on. The fighter was powered by an uprated WP-13F1 turbojet. The J-7D could carry the more advanced PL-7 and PL-8 short-range AAMs (the latter model is similar to the Israeli Rafael Python 3) but still lacked BVR combat capability.

Development began in 1988, and the aircraft first flew on 20th August 1991. The trials programme involved six prototypes serialled '401 Red' through '404 Red', '950155 Red' and '50156 White'.

The J-7D was cleared for production in November 1994 and achieved initial operation capability in 1995. By then, however, the PLAAF had already placed its bets on more capable fighters such as the Su-27SK (built under licence as the J-11), Su-30MKK and Shenyang J-8B. According to media reports, a production batch of twenty or thirty J-7Ds was built before production finally stopped in 1999. Again, the fighter was offered for export as the F-7D with provisions for carrying Matra R.550 Magic AAMs but attracted no orders.

'50156 White', one of the J-7 IIIA (J-7 IV) prototypes, with PL-5 AAMs outboard and PL-8 AAMs inboard. The lopsided PLAAF 'star and bars' insignia indicate the picture has been retouched.

Chengdu JZ-7 tactical reconnaissance aircraft

A tactical photo reconnaissance version of the J-7 II was brought out as the JZ-7 (*jianjiji zhenchaji* – reconnaissance fighter); this was the Chinese counterpart of the MiG-21R. In addition to the aerial camera, the JZ-7 could carry an indigenous electronic intelligence (ELINT) pod and was the first PLAAF aircraft to do so.

Chengdu Sabre II tactical fighter (project)

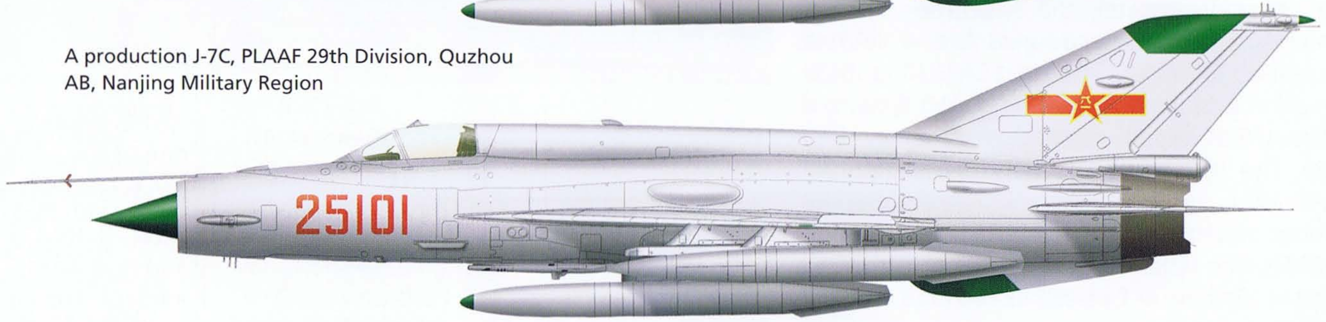
As a follow-on to the stillborn Super-7 project, the Northrop Corp. (now Northrop Grumman) devised an F-7P upgrade for the PAF. The aircraft was extensively redesigned, featuring a conventional ogival radome housing a General Electric AN/APG-67 radar as fitted to the Northrop F-20 Tigershark fighter. The engine breathed through lateral intakes in the wing roots; the wings featured wingtip missile rails and small leading-edge root extensions (LERXes). The programme was terminated after the student unrest in Beijing's Tiananmen Square in June 1989 which was ruthlessly squashed, causing sanctions to be imposed on China.

'402 Red', one of the J-7 IV (J-7D) prototypes operated by CFTE. Note the under-nose blade aerial characteristic of this version.

The first prototype J-7 III (J-7C) in late demonstrator colours

A production J-7C, PLAAF 15th Division, Huairen AB, Beijing Military Region

A production J-7C, PLAAF 29th Division, Quzhou AB, Nanjing Military Region



Chengdu J-7E tactical fighter

In 1987 the Chengdu Aircraft Corp. (CAC) began development of a further version designed to supersede the J-7II/F-7B. Designated J-7E, the aircraft introduced a host of improvements concerning aerodynamic performance and avionics.

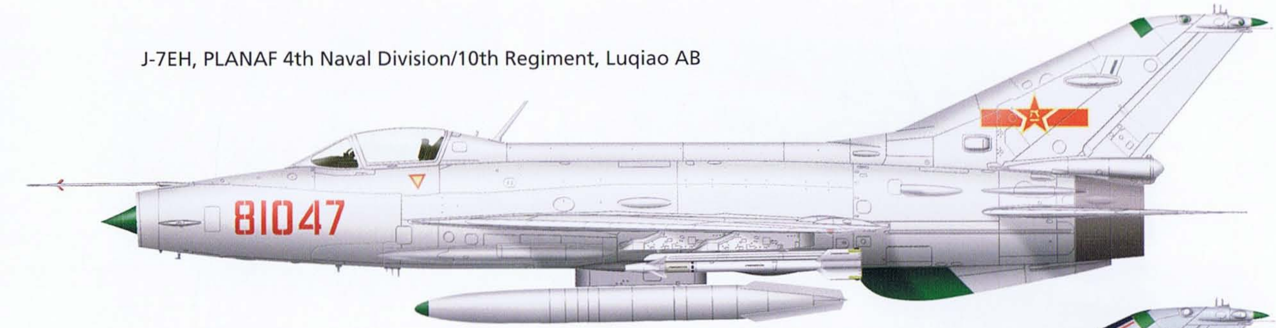
The most important change was the new wings of double-delta planform. The leading-edge sweep was reduced from 57° to 42° on the cambered outer wing portions, which incorporated leading-edge flaps. The trailing edge was also kinked, with forward sweep outboard of the flaps, and the boundary layer fences were deleted. The wing span increased from 7.15 to 8.32 m (from 23 ft 5½ in to 27 ft 3½ in), while gross wing area was increased 8.17% – from 23.00 to 24.88 m² (from 247.6 to 267.8 sq ft). This design offered much-enhanced manoeuvrability and field performance. In addition, the wings were 'wet', incorporating integral tanks; this doubled the internal fuel load as compared to the J-7 IIA.

The J-7E was powered by a WP-13F engine delivering 4,500 kgp (9,920 lbst) dry and 6,600 kgp (14,550 lbst) reheat. (Some sources, though, state the slightly less powerful WP-7F with an identical dry rating and a 6,500-kgp (14,330-lbst) afterburner rating.)

The fighter was fitted with a Type 226 pulse-Doppler radar (apparently a copy of the GEC-Marconi Skyranger) for the home market or a GEC-Marconi Super Skyranger or FIAR Grifo 7 radar for export. The avionics suite included a JT-1 HUD, a Type 8430 air data computer, a JD-3 TACAN system and a KG-8605 built-in active jammer. A Type 941-4AC chaff/flare dispenser was fitted for self-defence. The J-7E was the first Chinese fighter to incorporate the hands-on-throttle-and-stick (HOTAS) concept.

'95154 Black', one of the J-7E prototypes, wore this garish demonstrator colour scheme.

J-7EH, PLANAF 4th Naval Division/10th Regiment, Luqiao AB



A J-7E prototype, Chengdu Aircraft Corp.

J-7E, PLAAF 3rd Division/7th Regiment, Wuhu, Nanjing Military District

The built-in armament was restricted to a single Type 30-1 cannon with 60 rounds on the starboard side. The four wing pylons could carry up to 2,000 kg (4,410 lb) of ordnance – AAMs, bombs and FFAR pods. The two outboard wing stations could carry 480-litre drop tanks.

The designers made large-scale use of new technologies, including computer-aided design and computer-aided manufacturing (CAD/CAM), numerical control processing, laser/electromagnetic tests, composite materials, and high-pressured water cuts when developing the J-7E.

The J-7E prototype made its first flight in May 1990. Flight tests showed that the rate of climb at sea level had increased from the J-7 IIA's 155 m/sec (30,500 ft/min) to 195 m/sec (38,380 ft/min); the ferry range increased from 1,500 to 2,200 km (from 931 to 1,366 miles), and the operational G limit was increased from +7 to +8.

The flight tests were completed by 1992. The fighter entered PLAAF and PLANAF service in 1995, remaining in production until superseded by the J-7G in 2002-03; several hundred were delivered to the Chinese armed forces and foreign customers (export versions are dealt with separately).

According to CAC, the J-7E's overall performance was improved 43% as compared with the J-7B, while combat effectiveness was increased by an impressive 84%. The J-7E demonstrated that Chinese aeronautical engineering had reached a certain level of maturity and was now able to produce innovative and effective designs on its own instead of

A pair of J-7EHs (naval J-7Es) operated by the 4th Naval Division/ 10th Regiment patrols the skies, carrying PL-2 AAMs and drop tanks.

Two J-7EBs in the old colours of the 'August 1st' display team. Note the lack of cannons characterising the aerobatic version.

The team is ready to taxi out for a display routine.

Later the team's J-7EBs gained a new blue/white livery.

simply copying existing foreign machines.

Chengdu J-7EB aerobatic aircraft

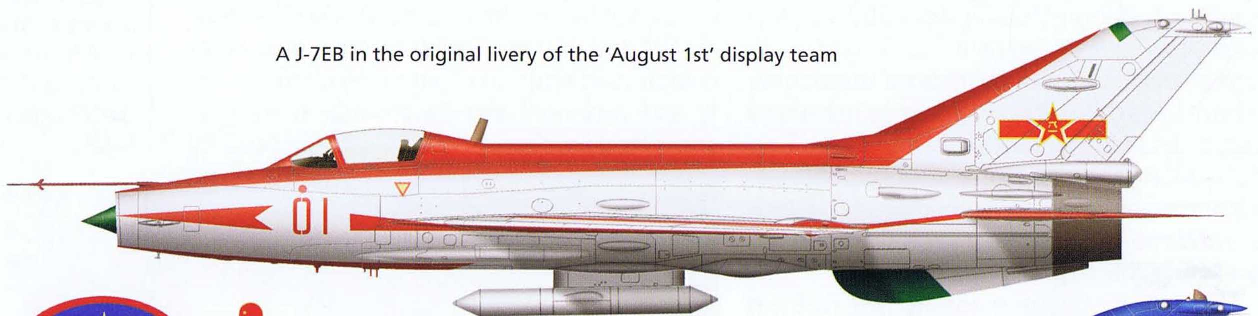
A special version of the J-7E was developed for the PLAAF's 'August 1st' display team, replacing the previously operated special version of the Chengdu JJ-5 jet trainer. Designated J-7EB, the aircraft was stripped of armament and fitted with a smoke generator. The centreline pylon carried a cylindrical tank filled with a mixture of diesel fuel and dye; when fed into the engine this created a thick smoke trail.

A dozen J-7EBs were delivered to the team. The J-7EB remained the team's standard equipment until the team re-equipped with the more modern J-7GB (which see).

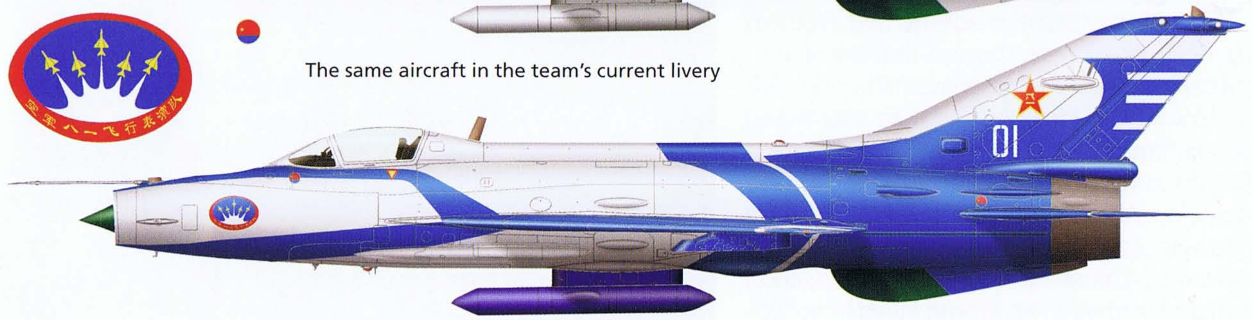
Chengdu J-7EH naval tactical fighter

A special version based on the J-7E was evolved for the PLANAF; it was capable of carrying anti-shipping missiles such as the turbofan-powered YJ-2 (export designation C-802; YJ stands for *Ying Ji* – 'Eagle Strike', a generic name for anti-shipping missiles). The aircraft was designated J-7EH; the H suffix again referred to an enhanced strike capability. However, the limitations of the fighter's radar do not allow the J-7EH to engage shipping targets independently; after launch the anti-ship missile is passed on to another aircraft acting as a target designator.

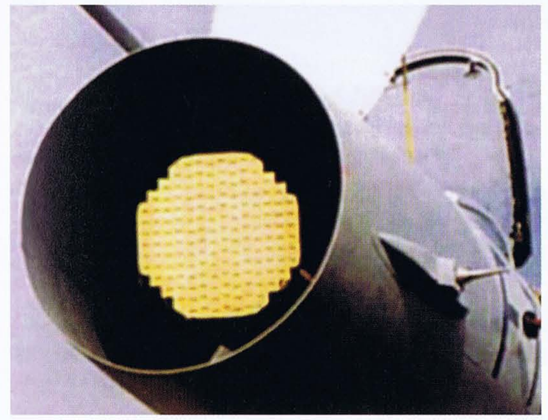
A J-7EB in the original livery of the 'August 1st' display team



The same aircraft in the team's current livery

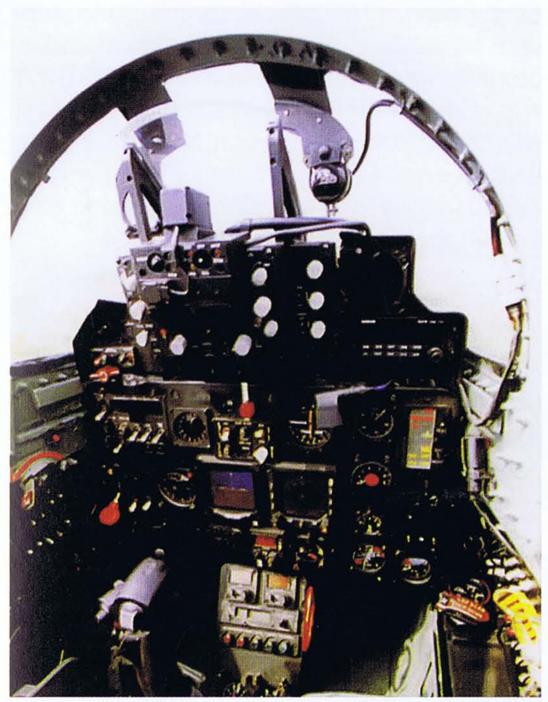


One of the F-7MG prototypes, CAC 0144, sits on the factory apron at Chengdu amidst an array of weapons (including Sidewinder AAMs), with unpainted J-7Es awaiting delivery in the background. Two cannons are displayed, although CAC 0144 has only one cannon.



An F-7MG prototype with the radome removed to expose the scanner of the FIAR Grifo MG radar.

CAC 0142 with a weapons array. This aircraft indeed had two cannons.



The cockpit of the F-7MG.

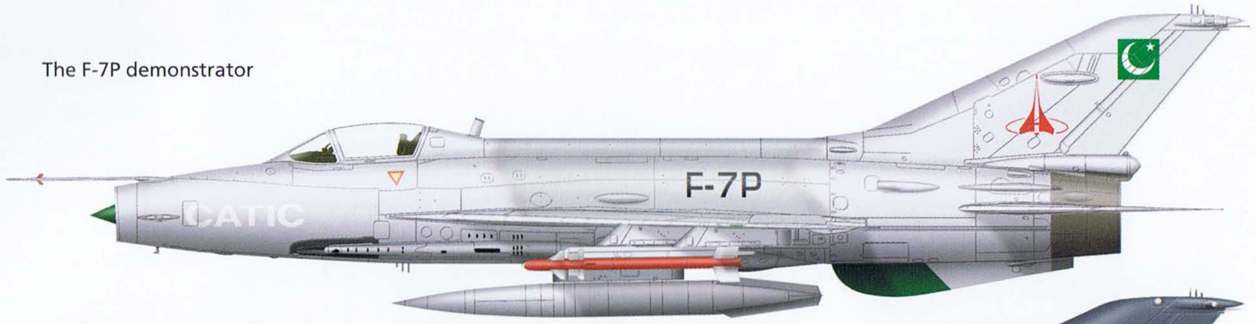
Chengdu J-7MG tactical fighter

The designation J-7MG was used for the demonstrator of the J-7E's export version fitted with a Martin-Baker ejection seat. Pakistan and Bangladesh evaluated the aircraft and were pleased with it, ordering the F-7MG version (see next entry).

Chengdu F-7MG tactical fighter

The F-7MG was the export version of the J-7E equipped with a GEC-Marconi Super Skyranger radar, Allied Signal avionics and a Martin-Baker ejection seat. The G suffix stood for *Gai* (Chinese for 'modified' or 'upgraded'). The fighter had a 850-km (527-mile) radius of

The F-7P demonstrator



F-7MG CAC 0143 with delta wings after repaint as the F-7PG demonstrator

F-7MG prototype CAC 0144 with double-delta wings

action; the ordnance load was reported as 1,800 kg (3,970 lb). Chinese specialists asserted that, as compared to the F-7M, the F-7MG's agility was improved by 43%; overall combat efficiency in air superiority mode was 83.9% higher and the rate of climb was 24%

In due course F-7MG CAC 0143 was repainted as the F-7PG upgrade demonstrator but retained the original wings.

higher. The take-off and landing distances were 30% and 28.6% shorter respectively. The pilot workload was reduced thanks to the more efficient cockpit layout with improved ergonomics.

At least three prototypes (CAC 0142, CAC 0143 and CAC 0144) were involved in the trials. Interestingly, the first two aircraft retained the old cropped-delta wings at first; CAC 0142 was later converted to full F-7MG standard. Originally all three aircraft had the standard three-piece windshield with a flat bulletproof windscreen. Later, however, CAC 0142 was refitted with a one-piece curved birdproof windshield; the new design became a standard fit on the F-7MG. Another peculiarity of CAC 0142 was the provision of a second cannon on the port.

Chengdu F-7PG tactical fighter

After evaluating the F-7MG in July 1997, the Pakistan Air Force requested a number of design changes before placing an initial order for 50 aircraft which was subsequently followed by a second order for 30. Designated F-7PG, the Pakistani version featured a FIAR Grifo MG fire control radar instead of the GEC-Marconi Super Skyranger. As compared to the earlier Grifo Mk II used on the F-7P, the new radar had a scan sector increased to ±30°, as well as better look-down/shoot-down capabilities. Like the earlier model, the radar was to be assembled under Italian licence in Pakistan. Unlike all other double-delta versions, the F-7PG had two cannons fitted as standard.

Deliveries of production F-7PGs began in June 2001 to replace the Shenyang F-6Cs flown by the PAF's No. 17 and No. 23 Squadrons. This made it possible to phase out the F-6C in 2002.

Chengdu J-7FS development aircraft

In the late 1990s CAC developed a version designated J-7FS. This was meant as a technology demonstrator for an affordable and yet effective upgrade package for the standard production J-7 II.

The J-7FS differed markedly in its appearance from all other versions of the family, having a large conical radome with a rectangular-section chin air intake. The radome could accommodate a much larger radar antenna than the centrebody of the standard J-7's air intake. The aircraft was refitted with a more powerful WP-13 IIS engine, a cooling system for the radar and other avionics, and a GPS navigation receiver.

Two J-7 II airframes were converted to J-7FSs – one for flight test and the other as a static test article. Serialled '139 Red', the prototype first flew on 8th June 1998. In the course of the trials it was refitted with double-delta wings borrowed from the J-7E and a squared-off fin cap. Eventually the programme was abandoned in favour of the more promising J-7MF project (see below).

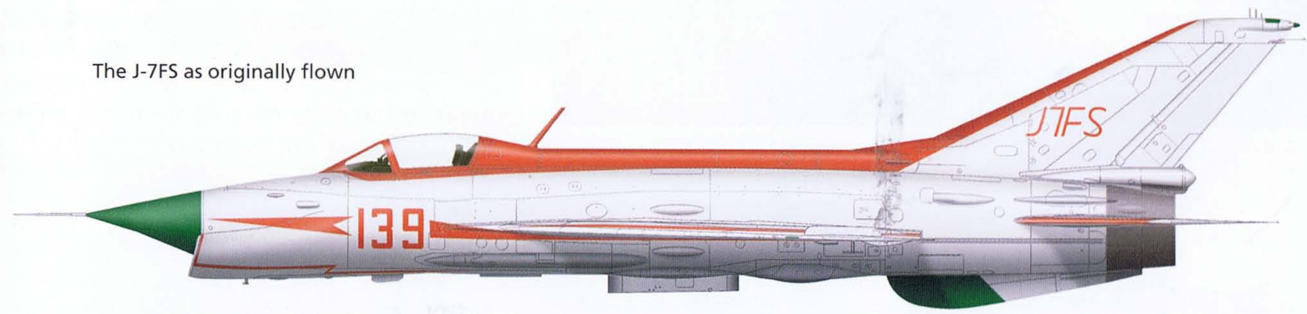
The J-7FS development aircraft in its original guise with standard wings and vertical tail. Note the lack of cannons.

The J-7FS in late configuration showing off the new double-delta wings and the revised fin cap.

Chengdu J-7MF tactical fighter (project)

This projected export model revealed in 2002 was an extensive redesign of the J-7E featuring a forward fuselage strongly reminiscent of the Eurofighter EF2000 Typhoon II – or the CAC J-10, with a large ogival radome and a two-dimensional variable ventral air intake positioned well aft. Another new feature was the small all-movable canard foreplanes for aerodynamic performance improvement. As distinct from the J-7FS, the nose gear unit had twin wheels and retracted aft, not forward.

The J-7FS as originally flown



The J-7FS in the definitive configuration

A model of the projected F-7MF.

The cockpit had a bubble canopy and a frameless curved windshield. There were three pylons under each wing.

The new forward fuselage design permitted installation of a modern pulse-Doppler radar with a detection range in excess of 80 km (50 miles). The cockpit featured an HUD and two multi-function displays, plus HOTAS controls. The project did not reach the hardware stage.

An artist's impression of the F-7X.

Chengdu F-7MF tactical fighter (project)

Italy proposed an export version of the J-7MF equipped with the proposed FIAR Grifo M radar and called F-7MF. The plan was abandoned in favour of the Chengdu FC-1 (JF-17).

Chengdu F-7X multi-role export fighter (project)

Taking this line of development further, CAC proposed the F-7X multi-role fighter intended for the foreign market. Actually very little is left of the original F-7 in this project; the radome, the canopy and the boxy ventral air intake are all similar to those of the Typhoon II, while the tail surfaces bear a striking resemblance to those of the Lockheed Martin F-16 Fighting Falcon. In particular, the single curved ventral fin is replaced by two canted trapezoidal fins and the brake parachute is housed in a much larger boxy fairing akin to that of European F-16s. The wings do retain a likeness to those of the F-7M (that is, a cropped-delta shape with a straight trailing edge) but feature large scimitar-shaped LERXes; there are no canards this time. There are four wing hardpoints.

Chengdu J-7G tactical fighter

An improved variant of the J-7E entered flight test in 2002. Designated J-7G, the fighter featured a new KLJ-6E pulse-Doppler radar – a Chinese copy of Italian Pointer 2500 (derived from the Israeli Elta Electronics EL/M-2001 radar). A licence-built helmet-mounted sight (HMS) of Russian design was integrated, allowing the J-7G to carry PL-8 AAMs, and a more powerful engine was installed. Outwardly the J-7G differed from the predecessor only in having a wraparound windshield. Production began in 2002, and the J-7G entered service with the PLAAF in 2003.

An F-7G with two cannons instead of one.

Chengdu J-7GB aerobatic aircraft

The J-7GB was a special unarmed version of the J-7G fitted with a smoke generator. It was developed as a replacement for the J-7EB and is the current equipment of the PLAAF's 'August 1st' display team. Again, twelve examples were delivered to the team, inheriting the codes '01 White' through '12 White'.

Chengdu F-7BG tactical fighter

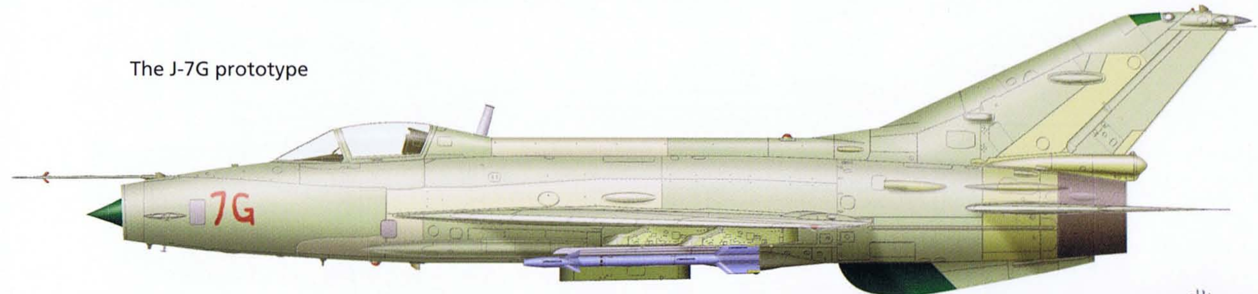
An export version of the J-7G was created to meet a requirement from the Bangladesh Air Force (BAF), receiving the designation F-7BG. Some sources say the F-7BG was able to carry a reconnaissance pod, like the F-7MB. Deliveries took place in 2005.

J-7G '20137 Yellow' operated by the PLAAF 12th Division/34th Regiment in a non-standard overall blue colour scheme.

Chengdu F-7NM tactical fighter

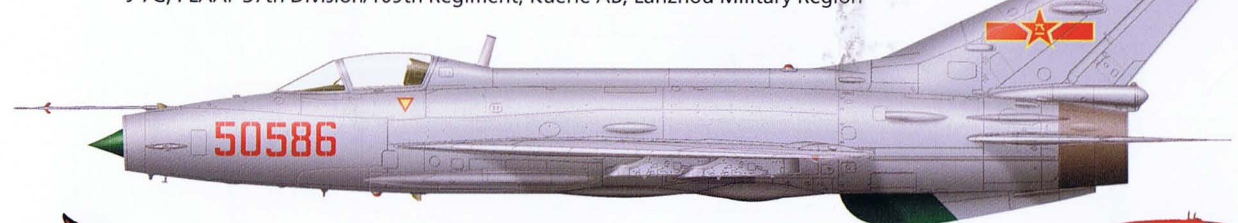
A version of the J-7G for the Namibian Air Force was designated F-7NM (some sources erroneously called it F-7NG). Twelve such aircraft were ordered in August 2005 and delivered in 2006, wearing F-7NM titles.

The J-7G prototype

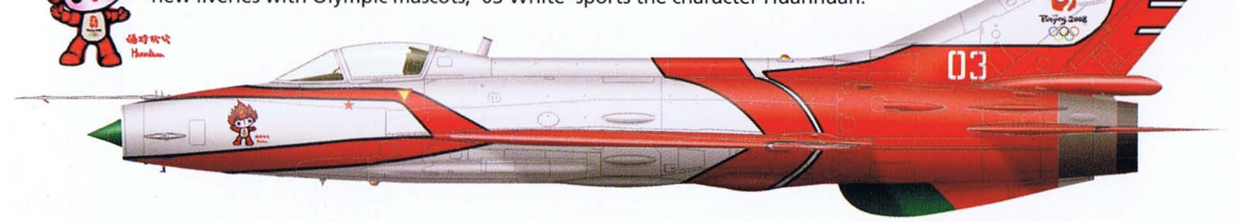


J-7G, PLAAF 12th Division/34th Regiment, Jinan-Jiaoqiang AB, Jinan Military Region

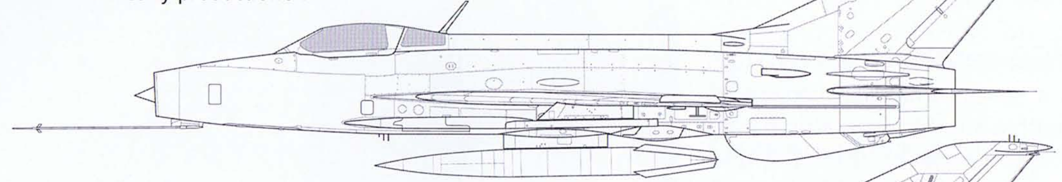
J-7G, PLAAF 37th Division/109th Regiment, Kuerle AB, Lanzhou Military Region



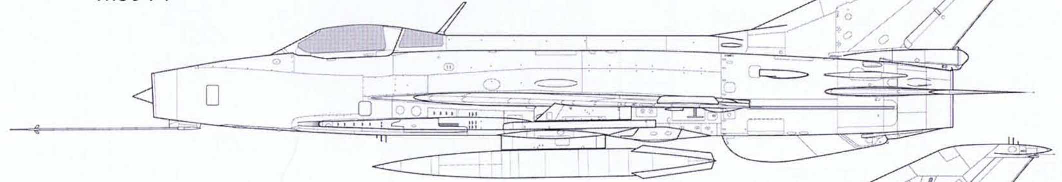
For the 2008 Olympic Games in Beijing five J-7GBs of the 'August 1st' team gained new liveries with Olympic mascots; '03 White' sports the character Huanhuan.



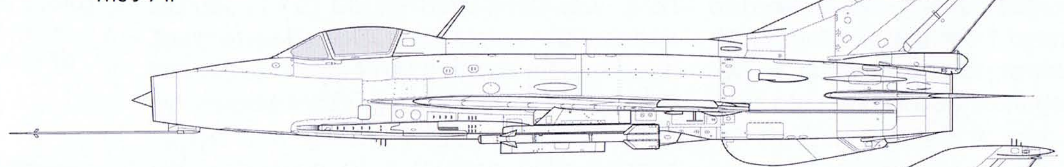
An early-production J-7



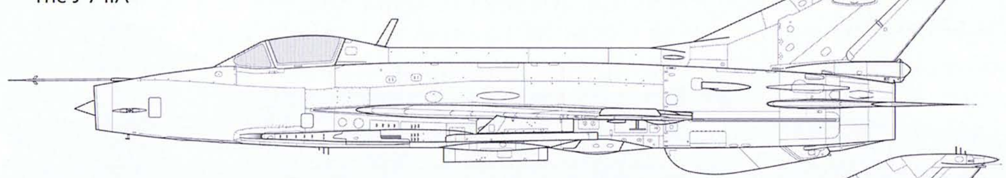
The J-7 I



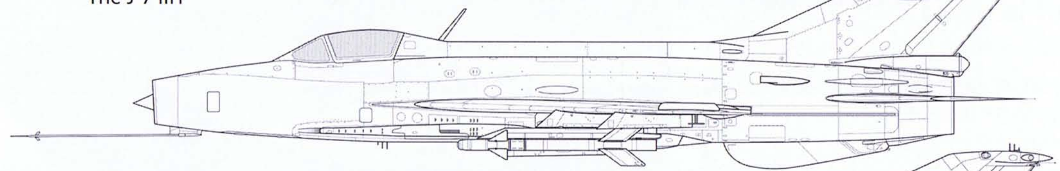
The J-7 II



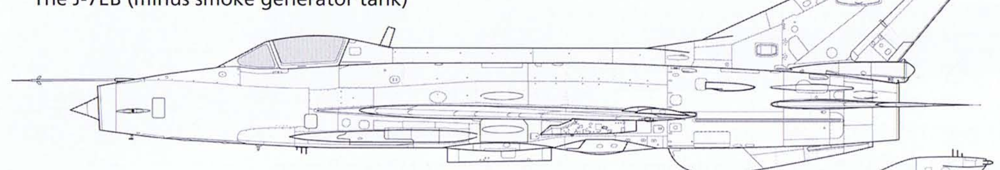
The J-7 IIA



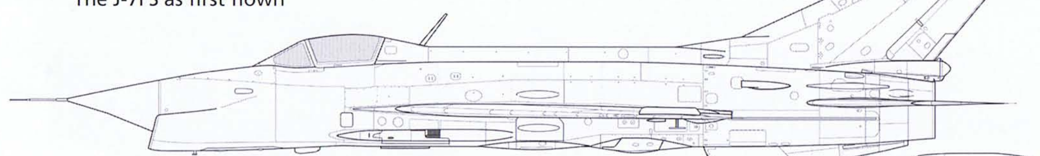
The J-7 IIH



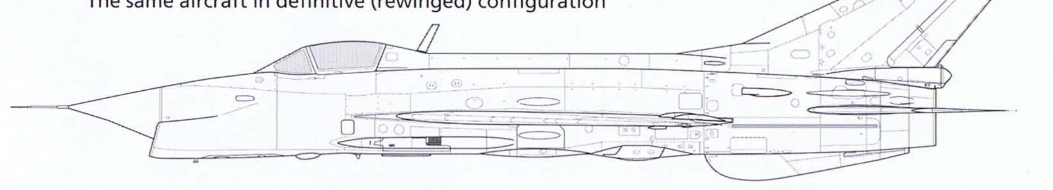
The J-7EB (minus smoke generator tank)



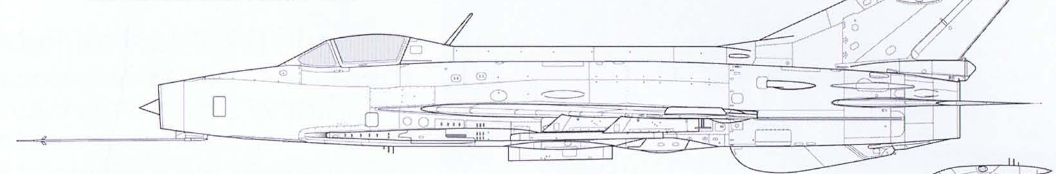
The J-7FS as first flown



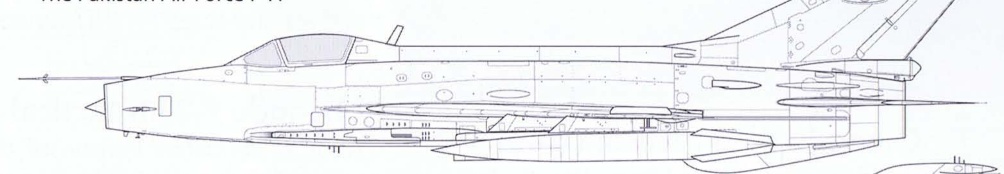
The same aircraft in definitive (rewinged) configuration



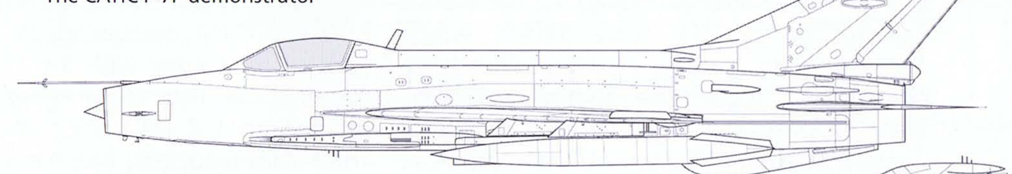
The Sri Lanka Air Force F-7BS



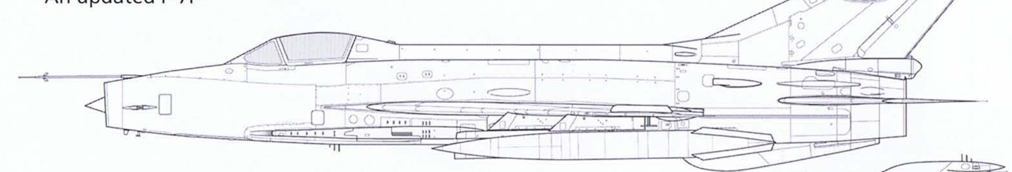
The Pakistan Air Force F-7P



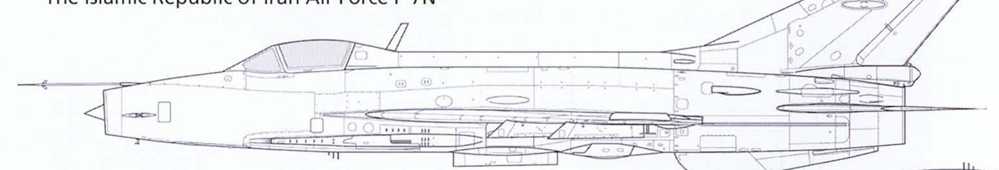
The CATIC F-7P demonstrator



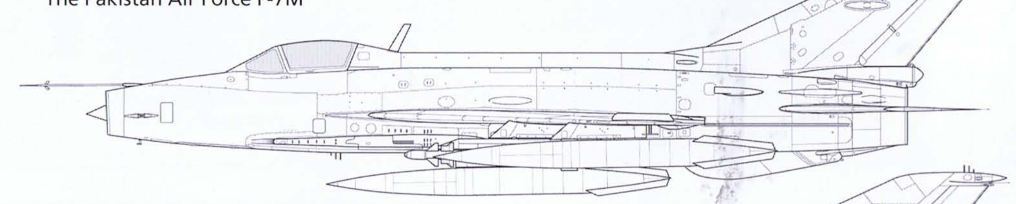
An updated F-7P



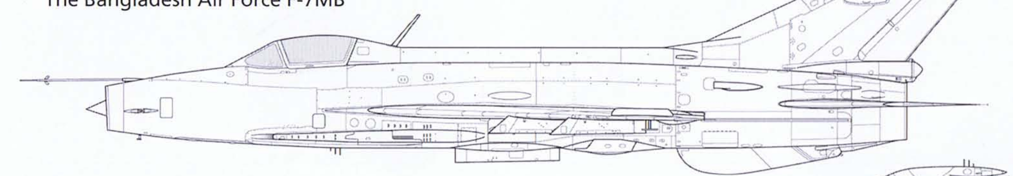
The Islamic Republic of Iran Air Force F-7N



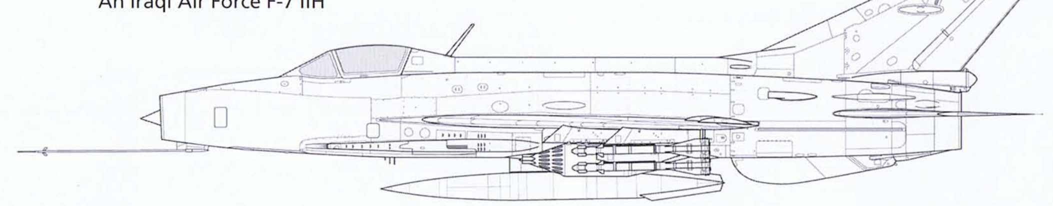
The Pakistan Air Force F-7M



The Bangladesh Air Force F-7MB



An Iraqi Air Force F-7 IIH



A Namibian Air Force F-7NM, still wearing the delivery serial 0310 and large 'F-7NM' titles, at Grootfontein.

Chengdu F-7N tactical fighter

The F-7N was a simplified version of the old F-7M export model developed for the Islamic Republic of Iran Air Force (IRIAF), which ordered 18. Because Iran had long since been branded as a 'rogue state' and military equipment supplies had been embargoed, using western avionics was impossible and the F-7N was fitted with Chinese avionics, reportedly including an SY-80 pulse-Doppler radar.

Chengdu F-7NI tactical fighter

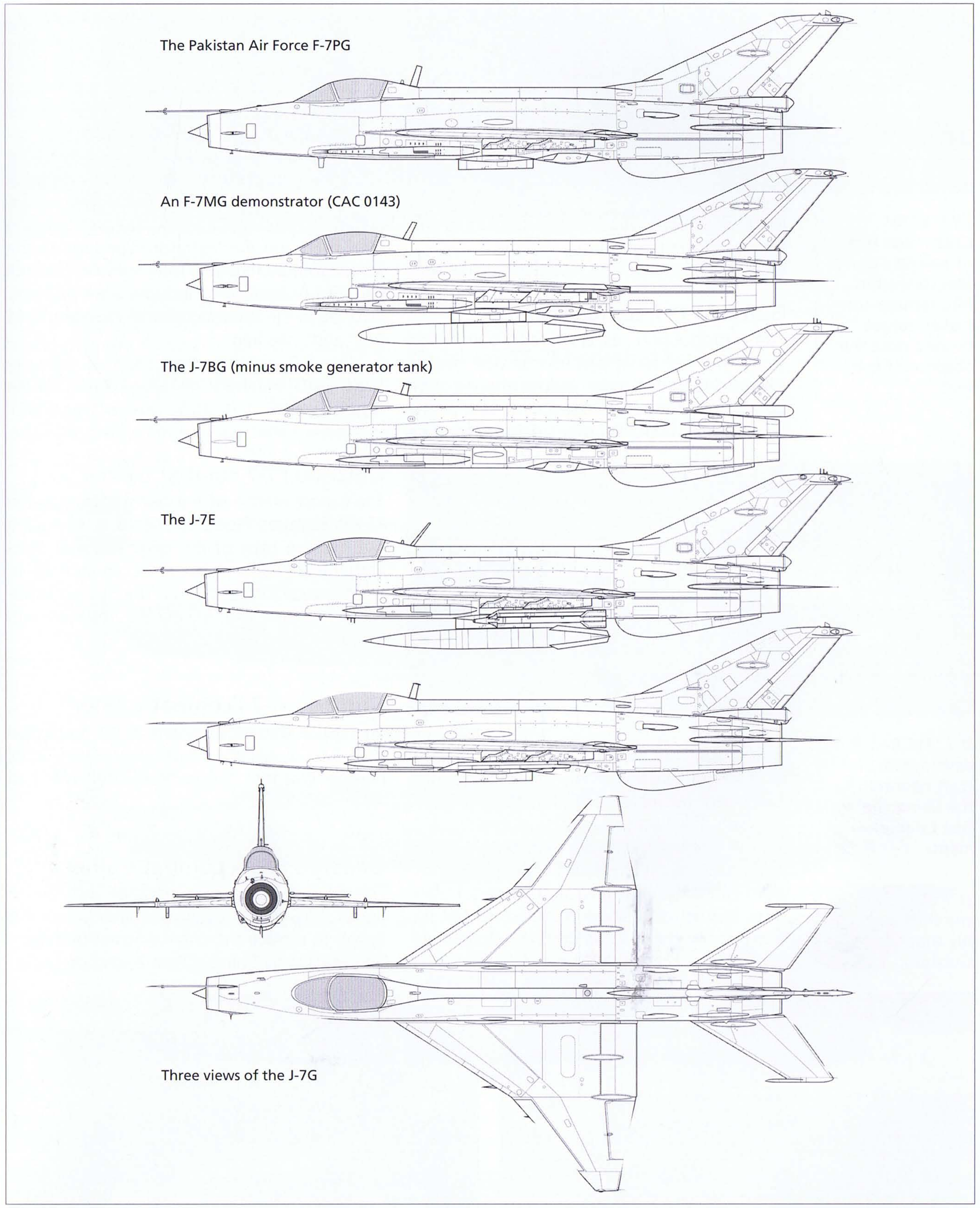
Nigeria, which became an important partner of China after a series of significant oil deals, placed a US$ 251 million order for fifteen combat aircraft for the Federal Nigerian Air Force (FNAF) – twelve F-7NI multi-role combat aircraft and three FT-7NI trainers (see below).

Chengdu F-7 IIN tactical fighter

Another simplified version of the F-7M fitted with Chinese avionics was supplied to Zimbabwe. It represented a cross-breed of the F-7B and F-7M, combining the low-mounted pitot of the former with the four wing hardpoints of the latter. These fighters received the designation F-7 IIN (which is unconfirmed). The F-7 IIN reportedly had the JL-7A radar.

J-7GBs '01 White' through '05 White' were painted in different colours to advertise the 2008 Summer Olympic Games in Beijing.

Brand-new F-7N fighters awaiting delivery to the Islamic Republic of Iran Air Force.



The Pakistan Air Force F-7PG

An F-7MG demonstrator (CAC 0143)

The J-7BG (minus smoke generator tank)

The J-7E

Three views of the J-7G

Chengdu J-7 target drone version

Many early-model J-7s (mainly J-7 I fighters) approaching the limit of their service life were converted to remote-controlled target drones. Such aircraft were readily identifiable by the absence of the ejection seat, since the cockpit now accommodated part of the guidance equipment. Two late-production J-7 Is ('12701

J-7 I '12701 Green' was one of several examples converted into remote-controlled target drones; note the absence of the seat.

Black' and '12702 Black') were apparently prototypes of the target drone version.

Guizhou JJ-7 combat trainer

The introduction of a second-generation supersonic fighter into PLAAF service created the need for a conversion trainer offering comparable performance. Hence in 1979 the Guizhou Aircraft Factory assisted by the Guizhou Aircraft Design Institute started work on a trainer version broadly similar to the narrow-tailed MiG-21U (NATO reporting name *Mongol*). The two-seater was designated JJ-7.

The Chinese trainer differed from its Soviet progenitor in several respects. It had twin outward-canted ventral fins of trapezoidal planform instead of a single rounded ventral fin. Additionally, the JJ-7 featured the characteristic Chinese brake parachute fairing with a hemispherical aft end and the pitot boom was offset to starboard. As on the MiG-21UM/US, the canopy of the rear cockpit incorporated a forward view periscope. Changes were made to the air intake, the fuel system and the crew escape system.

Prototype construction began in October 1982, even before the design effort was completed in 1983. Low-rate initial production began in 1983. Static tests were completed in May 1985 and the first prototype took to the air on 5th July that year with Yan Xiufu at the controls. At least six prototypes were probably involved in the test programme, including '144 Red' and '146 Red'.

The JJ-7 entered production in February 1986 and received its type certificate in February 1988.

JJ-7 '414 Red' is a development aircraft operated by the China Flight Test Establishment.

Guizhou FT-7 combat trainer

The export version of the JJ-7 was designated FT-7. It featured Type 2 ejection seats replacing the Chinese copy of the original Soviet seats and the equipment could be configured to meet the customer's needs. The FT-7 was supplied to Bangladesh, Myanmar, Zimbabwe and Sri Lanka.

Guizhou JJ-7 I combat trainer

This was a domestic version of the JJ-7 fitted with Type 2 ejection seats. Only a very small number was built before production switched to the JJ-7 II.

Guizhou FT-7A combat trainer

This was a conversion package offered to Soviet MiG-21U trainer customers, such as Egypt, to replace the original Soviet-built ejection seats with Chinese Type 2 ejection seats.

JJ-7 trainers in the final assembly shop at Guizhou.

A PLAAF 21st Division JJ-7 with an AoA sensor on the nose.

Guizhou JJ-7 II combat trainer

The JJ-7 II was an upgraded version of the JJ-7 I with Rockwell Collins avionics.

Guizhou FT-7B combat trainer

The export version of the JJ-7 II was designated FT-7B. It differed from the earlier versions in having Martin-Baker Mk 10L zero-zero ejection seats.

Guizhou FT-7M combat trainer

This export version was equivalent to the F-7M, featuring an updated avionics suite that included a HUD in the front cockpit.

FT-7 demonstrator with a Type 23-I cannon pod

JJ-7, PLAAF 21st Division, Shenyang Military Region

A JJ-7 II operated by an unknown PLAAF unit

FT-7P demonstrator

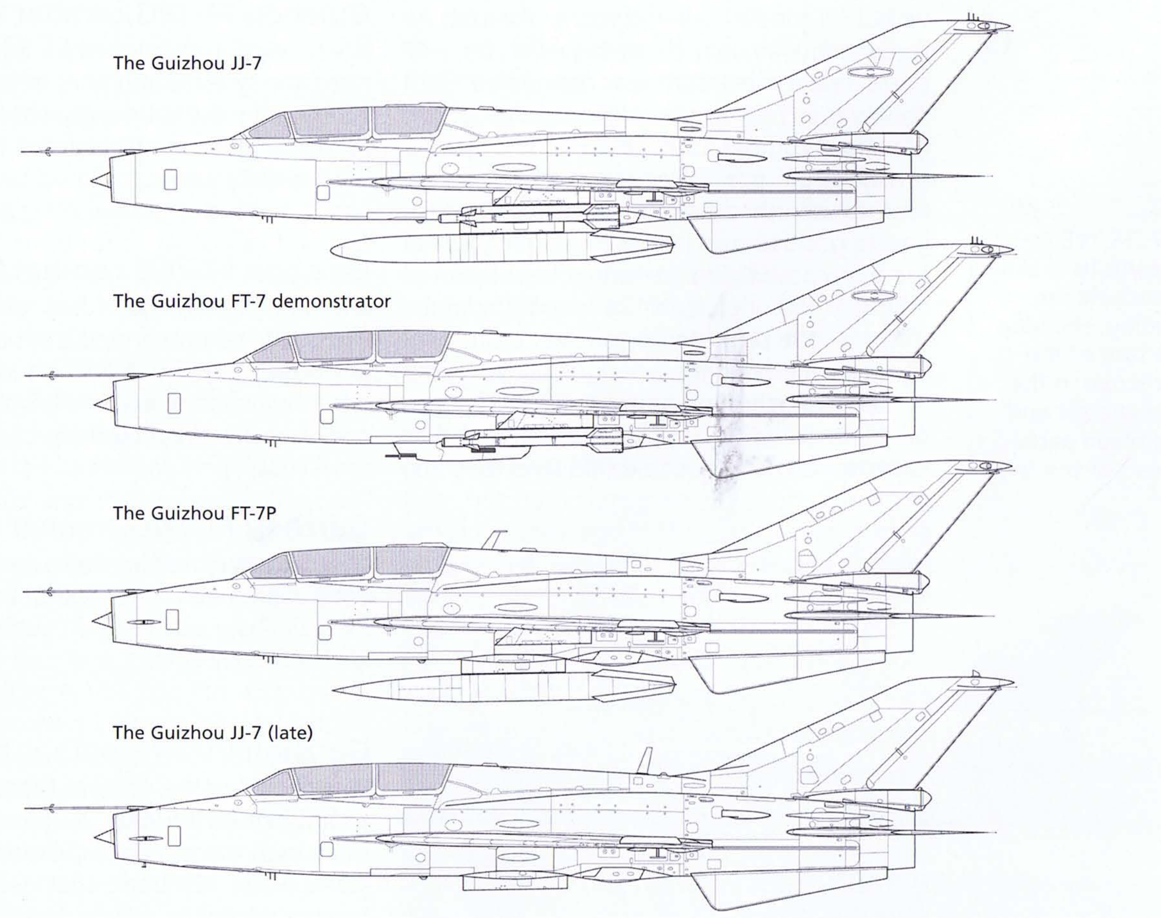
Specifications of the J-7 (F-7) family

	J-7 II	F-7M	J-7E	F-7PG	J-7C	JJ-7	FT-7P
Length overall (less pitot)	13.945 m (45 ft 9 in)	13.945 m (45 ft 9 in)	13.46 m (44 ft 2 in)	13.46 m (44 ft 2 in)	14.7 m (48 ft 2¾ in)	n.a.	n.a.
Length overall (including pitot)	14.885 m (48 ft 10 in)	14.885 m (48 ft 10 in)	14.885 m (48 ft 10 in)	14.885 m (48 ft 10 in)	n.a.	14.87 m (48 ft 9½ in)	15.47 m (50 ft 9 in)
Fuselage length	12.175 m (39 ft 11½ in)	12.175 m (39 ft 11½ in)	12.175 m (39 ft 11½ in)	12.175 m (39 ft 11½ in)	n.a.	12.175 m (39 ft 11½ in)	n.a.
Height on ground	4.105 m (13 ft 5½ in)	4.105 m (13 ft 5½ in)	4.125 m (13 ft 6 in)	4.125 m (13 ft 6 in)	n.a.	4.105 m (13 ft 5½ in)	n.a.
Wing span	7.15m (23 ft 5⅝ in)	7.15m (23 ft 5⅝ in)	8.32 m (27 ft 3½ in)	8.32 m (27 ft 3½ in)	7.15m (23 ft 5⅝ in)	7.15m (23 ft 5⅝ in)	7.15m (23 ft 5⅝ in)
Wing chord at root	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)	5.51 m (18 ft 0¾ in)
Wing chord at tip	0.46 m (1 ft 6¼ in)	0.46 m (1 ft 6¼ in)	n.a.	n.a.	0.46 m (1 ft 6¼ in)	0.46 m (1 ft 6¼ in)	0.46 m (1 ft 6¼ in)
Wing area, m² (sq ft)	23.00 (247.6)	23.00 (247.6)	24.88 (267.8)	24.88 (267.8)	23.00 (247.6)	23.00 (247.6)	23.00 (247.6)
Aileron area, m² (sq ft)	1.18 (12.70)	1.18 (12.70)	n.a.	n.a.	1.18 (12.70)	1.18 (12.70)	1.18 (12.70)
TE flap area, m² (sq ft)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)	1.87 (20.13)
Tailplane span	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)	3.74 m (12 ft 3¼ in)
Fin area, m² (sq ft)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)	3.48 (37.46)
Rudder area, m² (sq ft)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)	0.97 (10.44)
Horizontal tail area, m² (sq ft)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)	3.94 (42.41)
Landing gear track	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)	2.69 m (8 ft 10 in)
Landing gear wheelbase	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)	4.805 m (15 ft 9¼ in)
Empty weight, kg (lb)	5,275 (11,629)	5,275 (11,629)	5,292 (11,667)	5,292 (11,667)	n.a.	5,519 (12,167)	5,300 (11,684)
Normal TOW, kg (lb) †	7,531 (16,603)	7,531 (16,603) *	7,540 (16,623)	7,540 (16,623)	8,150 (17,967)	7,590 (16,733)	
Maximum TOW, kg (lb)	n.a.	n.a.	9,100 (20,062)	9,100 (20,062)	n.a.	8,555 (18,860)	9,550 (21,050)
Maximum ordnance load, kg (lb)	n.a.	n.a.	2,000 (4,410)	2,000 (4,410)	n.a.	1,187 (2,617)	n.a.
Wing loading at normal TOW, kg/m² (lb/sq ft)	n.a.	327.4 (67.06) *	n.a.	n.a.	n.a.	n.a.	n.a.
Max wing loading, kg/m² (lb/sq ft)	n.a.		379 (77.8)	365.8 (74.91)	n.a.	372.0 (76.18)	415.2 (85.04)
Power loading at normal TOW, kg/kgp (lb/lbst)	n.a.	1.23 *	n.a.	1.38	n.a.	1.4	1.56
Never-exceed speed above 12,500 m (41,010 ft), km/h (mph)		2,495 (1,550) Mach 2.35				2,495 (1,550) Mach 2.35	
Maximum level speed between 12,500 and 18,500 m (41,010-60,700 ft), km/h (mph)		2,175 (1,350) Mach 2.05	2,175 (1,350) Mach 2.05	n.a. Mach 2.0	2,300 (1,428)	2,175 (1,350) Mach 2.05	
Stalling speed (flaps deployed), km/h (mph)					210 (131)		250 (156)
Touchdown speed, km/h (mph)		300-320 (186-199)				305-325 (189-202)	
Max rate of climb at S/L, m/sec (ft/min)		180 (35,435)		195 (38,386)	150 (29,520)	155 (30,510)	
Acceleration from Mach 0.9 to Mach 1.2 at 5,000 m (16,400 ft), sec		35					

Max sustained turn rate, deg/sec:						
at S/L at Mach 0.7	n.a.	14.7	n.a.	n.a.	n.a.	n.a.
at 1,000 m (3,280 ft)	n.a.	n.a.	n.a.	16	n.a.	n.a.
at 5,000 m (16,400 ft) at Mach 0.8	n.a.	9.5	n.a.	11	n.a.	n.a.
at 8,000 m (26,250 ft)	n.a.	n.a.	n.a.	8	n.a.	n.a.
Service ceiling, m (ft)	18,200 (59,720)	18,200 (59,720)	18,800 (61,700)	17,500 (57,420)	18,000 (59,055)	17,300 (56,760)
Take-off run, m (ft)	700 (2,300)	700-950 (2,300-3,120)	600 (1,970)	600 (1,970)	800 (2,620)	827 (2,715)
Landing run w. brake parachute, m (ft)	600 (1,970)	600-900 (1,970-2,955)	600 (1,970)	600 (1,970)	500 (1,640)	1,060 (3,480)
Range with two PL-7 AAMs and three 500 litre drop tanks, km (miles)	n.a.	1,740 (1,080)	n.a.	n.a.	n.a.	n.a.
Ferry range w. two 500-litre drop tanks and one 800-litre drop tank /no AAMs, km (miles)	n.a.	2,230 (1,385)	2,200 (1,380)	2,200 (1,380)	1,900 (1,180)	1,010 (627) **
Combat radius, km (miles)	n.a.	n.a.	850 (528) ‡	850 (528) ‡ 550 (342) §	n.a.	n.a.
G limit (with 2 missiles)	+8	+8	+8	+8/–3	+8	+7

* F-7P † With two PL-2 or PL-7 AAMs ‡ Air superiority mission (hi-hi-hi), with three 720-litre (158.4 Imp gal) drop tanks and two AAMs or other light external stores (J-7E); with two AIM-9P AAMs and three 500-litre (110 Imp gal) drop tanks, including 5 minutes' combat with afterburner (F-7PG) § Ground attack mission (lo-lo-hi) with two Mk 82 bombs and two 500-litre drop tanks ** With one 720-litre drop tank

The performance of the F-7M is indicated at normal TOW with two PL-2 or PL-7 AAMs



An FT-7 demonstrator fitted with a Type 23-2 cannon.

Guizhou FT-7 demonstrator

A single FT-7 displayed at several international airshows featured a Type 23-II twin-barrel 23-mm cannon installed under the fuselage in lieu of the usual centreline pylon. The cannon was enclosed by a boxy fairing that was quite different from the neat fairing seen on the J-7C/D and the stretched FT-7P/FT-7BG (see below).

Guizhou FT-7P combat trainer

In 1989 GAIC began development of a special version of the FT-7 tailored to the Pakistan Air Force's requirements; by analogy with the F-7P single-seater the aircraft was designated FT-7P. This was a true combat trainer with greatly enhanced combat potential.

The FT-7P introduced significant changes. First of all, the fuselage was stretched by inserting a 610-mm (1 ft 11½ in) 'plug' aft of the rear cockpit. This permitted installation of a Type 23-II cannon with 186 rounds under the fuselage; the centreline pylon was located aft of the cannon fairing.

Secondly, the number of wing pylons was doubled to four. Thirdly, the internal fuel capacity was increased to 2,800 litres (616 Imp gal), extending the trainer's effective range by 25%; part of the extra fuel was housed in the recontoured fuselage spine, which was somewhat fatter than usual. Fourth, an uprated WP-7B engine was installed. Fifth, the back seat was installed 50 cm (1 ft 7 11/16 in) higher to provide a measure of forward visibility and the periscope was deleted. Finally, the FT-7P had the same basic avionics fit as the single-seat F-7P – a FIAR Grifo 7M radar (previous Chinese two-seat versions had no radar), an HK-03E HUD in the front cockpit, a digital mainframe computer and so on.

The FT-7P could carry up to four AAMs of various types, as well as FFAR pods and US Mk 82 450-kg (992-lb) free-fall bombs. Three drop tanks could be carried. Thus the FT-7P was fully combat capable.

The FT-7P entered flight test in November 1990. A total of 15 was delivered to the PAF.

JJ-7 '14 Yellow' streams its brake parachute on landing, showing the lack of the periscope in the rear cockpit and the blade aerial ahead of the fin.

Guizhou JJ-7A combat trainer

A similar stretched, cannon-armed variant was delivered to the PLAAF as the JJ-7A; apparently it was equipped with indigenous avionics.

Guizhou FT-7PG combat trainer

A later version developed for the PAF incorporated the systems upgrades introduced on the F-7PG and was thus designated FT-7PG. Unlike the latter, the aircraft did not have the new double-delta wings.

Guizhou FT-7BG combat trainer

The Bangladesh Air Force also ordered a stretched, cannon-armed combat trainer variant similar to the F-7BG in equipment fit, which was designated FT-7BG. Again, the aircraft had the old wing design.

Guizhou FT-7NG combat trainer

A version for the Namibian Air Force (apparently equivalent to the FT-7PG) was designated FT-7NG. Two such aircraft were delivered in November 2006.

Guizhou FT-7NI combat trainer

A version for the Federal Nigerian Air Force was designated FT-7NI. As mentioned earlier, three such trainers were delivered to the FNAF along with 12 single-seat F-7NI multi-role combat aircraft.

Shenyang J-8 interceptor

As early as 1964 a need arose for a long-range interceptor that would be a match for the latest American and Soviet combat aircraft. True, the J-7 (MiG-21F-13) was an excellent tactical fighter, but it lacked the range and altitude performance required for long-range intercept missions.

On 25th October 1964 the Chinese Aeronautical Establishment held a conference on the issues of high-performance fighter development. At the conference the Shenyang-based No. 601 Research Institute floated two concepts. One of them envisaged building a twin-turbojet aircraft that was, in effect, a scaled-up MiG-21F and employed the latter aircraft's design features. This concept, which received the designation J-8, offered the advantage of a low technical risk and earlier service entry and was therefore accorded higher priority by Tang Yanjie, President of the CAE. The target performance figures included a top speed of Mach 2.2, a service ceiling of at least 20,000 m (65,620 ft), a maximum climb rate of 200 m/sec (39,360 ft/min), a basic range of 1,500 km (931 miles) and a maximum range of 2,000 km (1,240 miles). The aircraft was to be capable of prolonged aerial combat at 19,000 m (62,340 ft).

From an early stage the J-8 programme gained major political importance and was closely followed by many senior political and military leaders, including the then Prime Minister He Long and Defence Minister Marshal Nie Rongzhen. On 17th May 1965 PLA Chief of General Staff General Luo Ruiqing approved the finalised operational requirements, clearing the way for detail design.

The J-8 was a fairly large aircraft having mid-set cropped-delta wings and a conventional swept tail unit featuring stabilators; both the wings and the stabilators had 60° leading-edge sweep and were positioned somewhat lower as compared to the J-7. The vertical tail was augmented by twin canted ventral fins whose shape resembled the J-7's single ventral fin. Two Liyang (LMC) WP-7B turbojets rated at 6,100 kgp (13,450 lbst) in full afterburner were housed side by side in the rear fuselage, with a MiG-19 style 'pen nib' fairing between the nozzles. The fighter had an axisymmetric nose air intake with a small fully adjustable shock cone; a pair of rectangular auxiliary blow-in doors was located immediately ahead of the wings to prevent surge at take-off power. The rear fuselage was detachable for engine maintenance and change. In common with the J-7 and J-7 I, the one-piece cockpit canopy was hinged at the front, doubling as a slipstream shield during ejection. The landing gear design was also borrowed wholesale – the nose unit retracted forward, the main units inward, the wheels rotating to stow vertically beside the inlet ducts. There were three ventral airbrakes positioned in the same way as on the J-7 (two ahead of the wings and one aft of them).

The armament consisted of two Type 30-1 (NR-30) cannons with 200 rpg buried in the fuselage below the cockpit; two external stores pylons were provided under the wings and a third on the centreline for carrying up to 2,500 kg (5,510 lb) of external stores. The centreline and outermost pylons were plumbed for carrying 1,400-litre (308 Imp gal) and 800-litre (176 Imp gal) drop tanks respectively. The air intake centrebody housed a radar rangefinder. An SM-8 gunsight was fitted. Overall the J-8 bore a certain resemblance to the Mikoyan Ye-152A experimental interceptor (NATO reporting name *Flipper*) but the proportions were rather different, with a slim, pencil-like fuselage.

Originally Huang Zhiqian was the J-8's chief designer; after his death in an aircraft crash in May 1965 he was succeeded by Wang Nanshou, who together with Ye Zhenda managed to complete the design work by September that year. A full-size mock-up was built and reviewed in December; the Shenyang Aircraft Factory was tasked with completing development by the end of 1966.

Inevitably, the chaos of the 'Cultural Revolution' had an impact on the J-8 programme. When Gao Fangqi (the chief engineer of the Shenyang Aircraft Factory) died in office, his successor Liu Hongzhi carried on with the preparations for prototype construction but was unexpectedly removed from office in November 1966; responsibility for the programme was then transferred to the so-called 'Joint J-8 Development Command' headed by Wang Xin.

In August 1967 the factory began construction of two prototypes; the first of these, '001 Red', was completed in June 1968. The work proceeded slowly because the aircraft were built almost clandestinely. On 19th December the first prototype began taxi tests; yet nose gear shimmy during a high-speed run resulted in an accident in which the aircraft was damaged. Following repairs, the J-8 made

'72065 Red', a J-8 operated by the FTTC, with photo calibration markings.

Still in primer finish, a brand-new J-8 I makes a test flight.

its first flight successfully on 5th July 1969 with Yin Yuhuan at the controls. Yet, shortly afterwards the flight test team and the Joint Flight Test Command were surprisingly disbanded, as was the chief design office in Shenyang – another effect of the 'Cultural Revolution'. The programme came to an almost complete standstill.

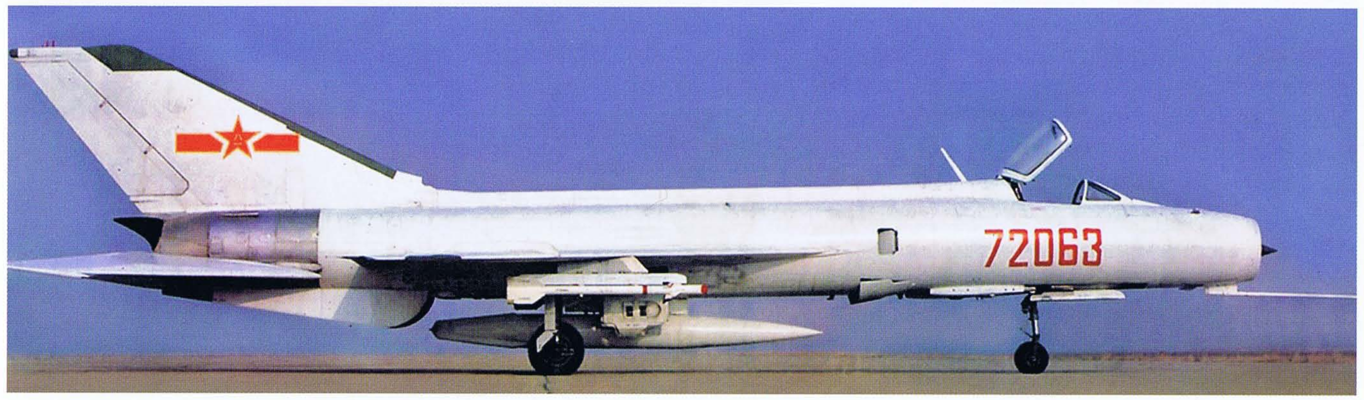
Between 1969 and 1979 the two prototypes ('001 Red' and '002 Red') made only 1,025 flights, logging 663 flight hours between them. The flight tests turned up major problems. For one thing, in 1969 severe Mach buffet set in at Mach 0.86, making the aircraft unable to exceed the speed of sound. The cause was traced to imperfections in the rear fuselage creating strong turbulence. Aerodynamic changes were made, but in 1977 the phenomenon recurred at transonic speeds, necessitating another redesign. Later, Mach buffet was experienced again at Mach 1.24; this time the solution was to develop and install a yaw damper in the rudder control circuit.

Secondly, the rear fuselage was prone to overheating at high Mach numbers, causing damage to the brake parachute located at the base of the rudder and even the surrounding structure. The problem surfaced in 1970 and was cured by a combination of enforced air cooling, heat insulation and the use of new structural materials.

Thirdly, the WP-7A engines tended to flame out and were generally unreliable at first. It took a while to solve the problem. Finally, static tests revealed that the airframe needed reinforcement in certain areas.

Test pilots Lu Mingdong, Hua Jun, Wang Ang and Su Guohua made a major contribution to eliminating the fighter's 'bugs'. In September 1978 the Chief Designer Office at the Shenyang Aircraft Research Institute was

These production J-8 Is show clearly the two-piece canopy and antenna built into the fin leading edge.



PLANAF 5th Division/15th Regiment J-8s at Qingdao. Note how the pitots fold away when parked to avoid damage. The later J-8 Is in the background make an interesting comparison.

J-8 '83552 Red' is refuelled before a sortie, showing the Type 30-1 cannons.

reinstated and Gu Songfen (who had been Vice Chief Designer from the outset of the J-8 programme) was appointed Chief Designer.

On 31st December 1979 the design of the J-8 was frozen, clearing the way for full-scale production. On 2nd March 1980 the aircraft was formally accepted for service. The NATO reporting name was *Finback-A*.

J-8 I (J-8A) all-weather interceptor

The original J-8 was obsolescent even as it entered flight test because its avionics and equipment did not meet the then-current requirements. Hence in February 1978 the designers of the reborn design bureau in Shenyang launched an upgrade programme. Known initially as the J-8 I (and ultimately redesignated J-8A), the updated interceptor differed from the original aircraft in the following ways. Firstly, an SR-4 (Type 204) fire control radar – the first indigenously developed aircraft radar – was installed in the air intake centrebody, replacing the inadequate radar rangefinder. Secondly, the original crew escape system was replaced by a new Type 2 ejection seat and a two-piece canopy with a fixed windshield and an aft-hinged portion (in the same manner as on the J-7 II). Thirdly, the armament was beefed up by replacing the Type 30-1 cannons with a pair of Type 23-III (GSh-23L) double-barrelled cannons – again

J-8 I '20058 Red', a PLAAF 24th Division/71st Regiment aircraft from Zunhua AB, shows its undersides and the Type 23-II cannons.

Two examples of the rarely seen JZ-8 reconnaissance version with a centreline camera pod operated by the 4th Independent Recce Regiment.

with 200 rpg – and integrating PL-4 AAMs, of which four could be carried.

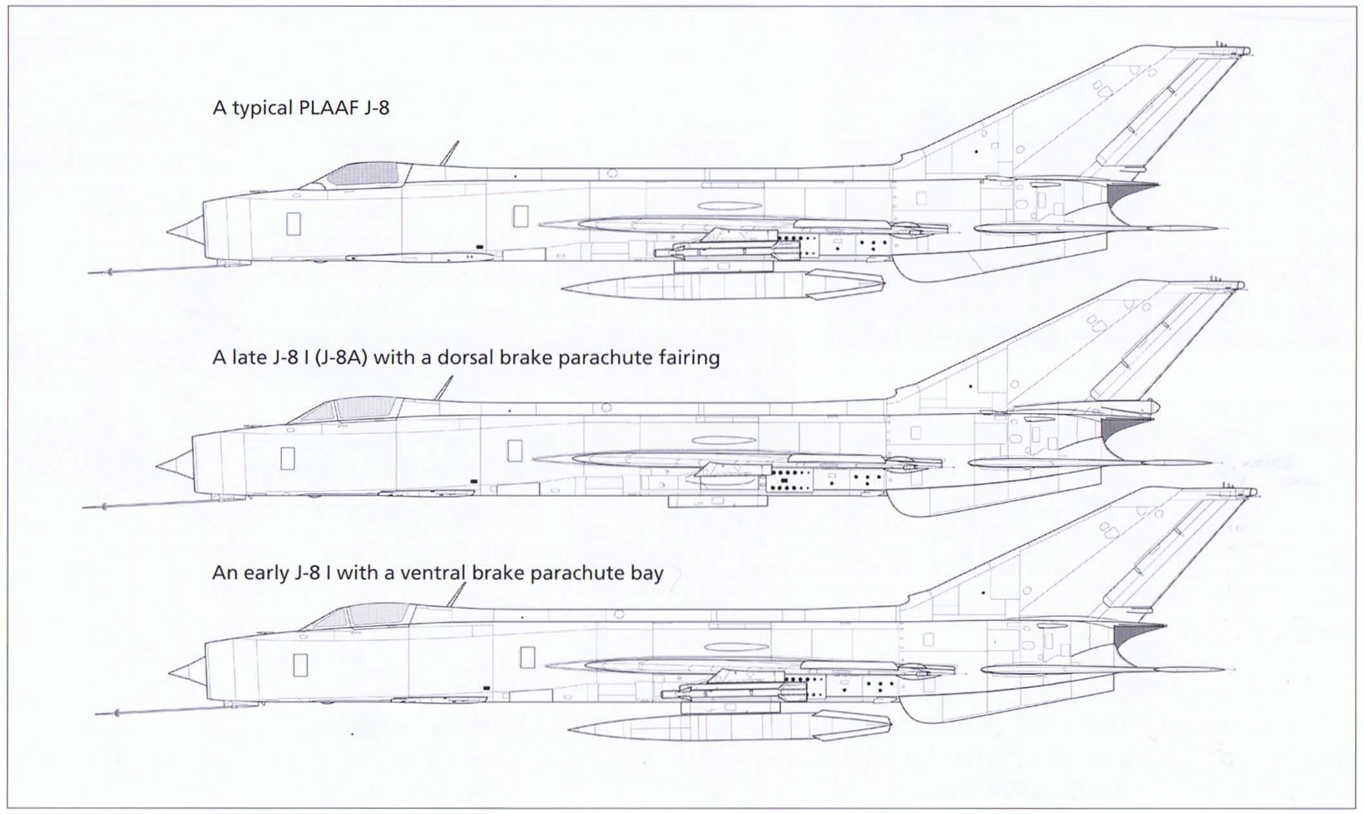
The planned changes were endorsed by the State Certification Commission on 2nd March 1980, even though neither the radar nor the missile were ready for service yet. The first prototype J-8 I was completed in May 1980, commencing ground tests. However, on 25th June the programme suffered a major setback when the prototype was lost in the course of the very first engine run – a burst hydraulic line in the engine bay caused a massive fire which destroyed the aircraft completely. This brought about a major rework of the hydraulic system on subsequent J-8s, delaying the programme by a full year.

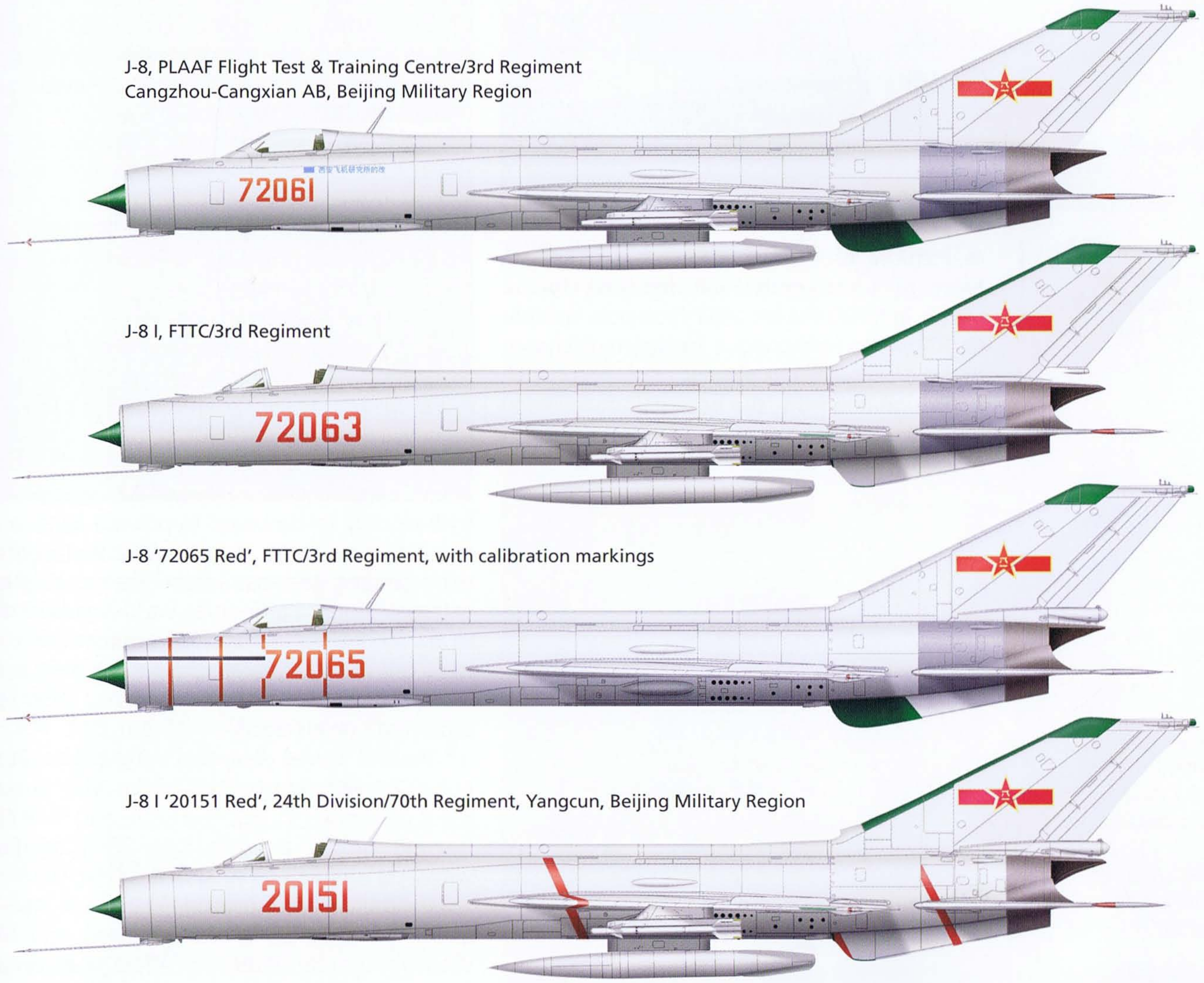
The second prototype made its maiden flight on 24th April 1981 with Lu Mindong at the controls, followed in October by the third prototype. A further J-8 I airframe completed static tests in July 1983.

The three-and-a-half-year test programme was completed in November 1984. On 27th July 1985 the J-8 I was cleared for production. The intended PL-4 AAM could not be brought up to scratch and was cancelled eventually, so the production fighters had to make do with PL-2B or PL-5 AAMs; pods with 55-mm or 90-mm FFARs could be fitted for strike missions. The fighter's performance fell short of the then-current world standards, and J-8 I production was terminated in 1987 after 100 or so had been built.

J-8 IE all-weather interceptor

After the advent of the more capable J-8 II part of the J-8 I fleet received a mid-life update and was relegated to units of secondary importance. Such aircraft had the original SR-4 radar replaced with the JL-7 radar taken from the





J-7C and shared the SM-8 optical sight, ECM equipment and flight instruments of the J-8 II. The upgraded aircraft were designated J-8 IE.

JZ-8 reconnaissance aircraft

Another result of the J-8 II's service introduction was that some J-8s were converted for high-altitude photo reconnaissance duties in the mid-1980s as a replacement for the outdated JZ-6. A large cylindrical pod housing a KA-112A long-range operation (LOROP) oblique camera was carried on the centreline pylon. The camera fired through two windows, having a 3.5° x 30° field of view, and was loaded with 610 m (2,001 ft) of film, which was enough for 550 exposures.

Designated JZ-8, the reconnaissance version had a maximum range of 2,000 km (1,240 miles) with two 480-litre (105.6 Imp gal) drop tanks; the normal operation altitude was 9,500-15,000 m (31,170-49,210 ft). A small number entered service with two PLAAF independent reconnaissance regiments.

J-8 ACT control configured vehicle

In the late 1980s a single J-8 was converted into a testbed known as the J-8 ACT (Active Control Technology). This aircraft was equipped with the first analogue FBW control system developed in China. The J-8 ACT first flew in this guise on 28th January 1989; later it was refitted with a more advanced digital FBW control system. The aircraft crashed on 23rd April 1991.

J-8 II (J-8B, F-8B) interceptor

The J-8's layout with the nose air intake did not permit installation of a modern fire control radar, severely limiting the aircraft's usefulness as an interceptor. Also, a need was perceived to enhance the fighter's manoeuvrability – a

A prototype of the radically redesigned J-8 II (with F-8II titles).

realisation brought about by the service entry of fourth-generation fighters abroad. Hence in 1980 the No. 601 Research Institute (SARI) began exploring a radical redesign of the interceptor.

Designated J-8 II, the new aircraft followed the trend set by such fighters as the McDonnell F-4 Phantom II and the MiG-23.

Three aspects of '840612 Black', the first prototype J-8 II. Note the folding ventral fin and the flow stabilisers in the air intakes.

The J-8 II was, in effect, a new aircraft, as 70% of the airframe structure and systems were reworked. The fuselage was area-ruled; the nose was occupied by an ogival radome large enough to accommodate the scanner of a powerful radar. The engines now breathed through lateral two-dimensional air intakes with boundary layer splitter plates. Speaking of which, the powerplant was also new; the J-8 II was powered by two WP-13A-II turbojets rated at 4,350 kgp (9,590 lbst) dry and 6,720 kg (14,815 lbst) reheat.

Another change concerned the tail unit: the twin ventral fins of the J-8 gave place to a single large fin whose design was borrowed from the MiG-23 (several examples of which, as the reader remembers, had been obtained from Egypt by then). The ventral fin folded hydraulically to starboard to provide adequate ground clearance, deploying concurrently wing landing gear retraction. The number of external stores hardpoints was increased to seven by adding an extra pain inboard of the main gear units. Overall, the J-8 II bore a certain resemblance to the Sukhoi Su-15 (NATO reporting name *Flagon*).

The J-8 II was equipped with a Type 208 pulse-Doppler fire control radar. The armament comprised PL-2B, PL-5B/C/E and PL-8 IR-homing AAMs; a single Type 23-III cannon with 200 rounds was retained.

The actual design work started in 1982 under the direction of Gu Songfeng and He Wenzhi; the development effort was quite extensive, involving 11,000 hours of wind tunnel research by the end of May 1984. The manufacturing drawings were issued to the Shenyang Aircraft Co. by May 1983 and the factory immediately began tooling up for production and manufacturing the prototypes. The first prototype (c/n J8II-01) was completed in March 1984 and made its maiden flight on 12th June, piloted by Qu Xueren; later the machine was serialled '840612 Black'. The development process was unbelievably short by Chinese standards, lasting a mere 17 months.

Flight tests showed that the aircraft had markedly higher performance than the J-8/J-8 I thanks to the higher thrust/weight ratio. Handing was also clearly improved, especially directional stability (poor directional stability had been one of the *Finback-A*'s greatest flaws). Manoeuvrability was improved only slightly because the aircraft had a G limit of 6.9. The biggest problems arose with the mission avionics, first of all the Type 208 radar, which took a long time to reach an acceptable level of performance (its detection range was only 60 km/37 miles).

One of the PLAAF aircraft repair factories with four 29th Division J-8 IIs undergoing refurbishment.

In October 1988 the J-8 II (also known as the J-8B) was cleared for production and service. The aircraft was operated both by the PLAAF and the PLANAF, receiving the NATO reporting name *Finback-B*. It was offered for export as the F-8B but found no takers.

J-8 IIB (J-8B Block 02) interceptor

A late version designated J-8 IIB or J-8B Block 02 first flew in November 1989. It had an upgraded KLJ-1 (Type 208A) radar giving look-down/shoot-down capability, an HK-13E HUD and some avionics items from the J-7C (a Type 563B INS, a JD-3 II TACAN system, a KJ-8602 RHAWS etc.). The weapons included PL-8 (IR-homing) and PL-11 (SARH) AAMs. The J-8B Block 02 was certified in December 1995, entering production in 1996.

J-8B 'Peace Pearl' upgrade project

Being aware that development of indigenous mission avionics might take too long, China took advantage of an improvement in Sino-American relations under the Reagan adminis-

J-8 II '11225 Red', a 1st Division/1st Regiment aircraft, is seen here with assorted external stores, including PL-5 (left) and PL-8 AAMs, Type 57-1 and Type 90-1 FFAR pods, and 250-kg low-drag bombs (plus a GDJ-4 multiple ejector rack).

Early morning shot of the 1st Regiment flight line at Anshan AB.

'72168 Red', a J-8 II operated by the FTTC/3rd Regiment, taxies at Cangzhou.

Two views of an F-8B export version demonstrator in appropriate colours.

tration to wheedle out the 'Peace Pearl' agreement in 1986. Part of this programme, which was formally launched on 5th August 1987, concerned the J-8 II, envisaging a US$ 502 million upgrade for 50-55 aircraft to be performed by Grumman Aerospace. The fighter was to receive a Westinghouse AN/APG-66(V) fire control radar (as fitted to the F-16), a new HUD, a new fire control computer, an up-to-date navigation suite and a Martin-Baker ejection seat. Some sources say that even a refit with General Electric F404-GE-400 afterburning turbofans came into consideration.

Two J-8 IIs ('0001 Red' and '11207 Red') were actually delivered to the USA as pattern aircraft and test-flown by USAF pilots. The upgrade work was already under way when student unrest in Beijing's Tiananmen Square was ruthlessly quashed by the government in July 1989, causing sanctions to be imposed on China (including a weapons embargo). Hence the upgrade programme was abandoned and

the two aircraft returned to China in their original condition.

J-8 III (J-8C) all-weather interceptor

SAC sought alternative ways and means of improving the J-8 II's combat potential. Thus, around 1990 the company established ties with the Israeli radar house Elta Electronics, requesting it to adapt the EL/M-2034 fire control radar to the J-8 II. The aircraft was to feature a HUD, a monochrome multi-function display, a navigation suite featuring INS/GPS and a new automatic approach/landing system. The powerplant was to consist of LMC WP-14 Kunlun afterburning turbojets rated at 7,500 kgp (16,530 lbst) in full afterburner. The new version was originally designated J-8 III but soon became the J-8C.

Front view of a J-8 IIA (J-8D) characterised by the removable IFR probe.

A naval J-8D of the 9th Division/25th Regiment at Lingshui AB configured for a strike mission.

The Air Force also had the IFR-capable version, as illustrated by '21106 Red', a 9th Division/25th Regiment (!) aircraft at Fo Shan.

The first prototype ('510 Red', c/n 8301) reportedly entered flight test in 1992; at least one more prototype ('511 Red') followed. Outwardly the J-8C differed from the standard model in having four wing fences instead of two and a detachable L-shaped in-flight refuelling (IFR) probe on the starboard side of the cockpit. The intended engines proved unavailable, so the prototypes were powered by WP-13B turbojets rated at 4,800 kgp (10,580

J-8H '60093 Red' climbs away with a single large bomb on the centreline.

Unlike the white-painted early versions, the J-8H wears a grey air superiority colour scheme.

The nose of a PLAAF 37th Division J-8H with ESM antennas aft of the radome.

A PL-5 short-range AAM on the inner wing pylon of a J-8H.

lbst) dry and 7,000 kgp (15,430 lbst) reheat. The Israeli radar later gave place to a Chinese Type 1471 radar.

Although the J-8C was certified around 1995, the WP-14 turbojet never materialised, causing production to be abandoned in favour of the more capable Su-27/J-11. However, the additional wing fences and the IFR probe found their way to the J-8F and J-8H.

J-8 IV (J-8 IIA, J-8D) interceptor

Some J-8Bs (mostly operated by the PLANAF) had IFR capability, featuring the same detachable refuelling probe on the starboard side as the J-8C. This probe was used for working with Xian HY-6 tankers, extending the combat radius from 800 km (496 miles) to 1,200 km (745 miles) during overwater operations. The aircraft was fitted with an improved Type 208B radar and HK-13E HUD; the rest of the avionics was similar to the J-8B Block 02. PL-8 AAMs were the principal weapon.

Designated J-8 IIA or J-8 IV but soon renamed J-8D, the new version first flew on 21st November 1990, was certified in the mid-1990s and entered service in 1996 as the first IFR-capable Chinese fighter. Its existence was first revealed when J-8Ds took part in the flypast in Beijing on 1st October 1999 to celebrate the 50th anniversary of the PRC. The original design of the IFR probe created a lot of aerodynamic noise in the cockpit, annoying the pilot, and had to be revised. The NATO reporting name was *Finback-B Mod*.

J-8H fighter/strike aircraft

Development of this version derived from the J-8D began in 1995 and the modifications were approved in 1999. The J-8H (*Hongzhaji*) featured a KLJ-1 (Type 1492) radar; the main armament consisted of PL-11 AAMs, and the aircraft was reportedly able to carry YJ-91 anti-radiation ASMs for the suppression of enemy air defences ('Wild Weasel') role. The J-8H entered service in 2002.

J-8F all-weather interceptor

This version continuing the J-8C line of development, being powered by WP13B II turbojets, fitted with an improved JL-10 (Type 1473) fire control radar and armed with PL-12 (SD-10) active radar-homing AAMs for beyond-visual-range (BVR) combat. Development began in 1999 and the prototype first flew in 2000.

JZ-8F reconnaissance aircraft

A reconnaissance version of the J-8F reportedly existed. Unlike the JZ-8, the reconnaissance camera was built into the forward fuselage, not carried in a pod; the camera fairing replaced the usual cannon.

This photo shows the purported JZ-8F reconnaissance version with a camera pack aft of the nosewheel well.

F-8 IIM all-weather interceptor

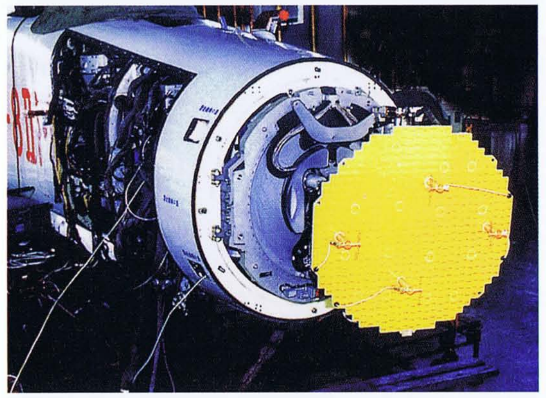
SAC offered an upgraded version of the J-8 II for export. Designated F-8 IIM, the aircraft was to feature an advanced Russian-built Phazotron Zhuk-8 II (Beetle) coherent pulse-Doppler X-band fire control radar having a detection range of 70 km (43.5 miles) and able to track ten targets while engaging two priority threats. The aircraft was powered by WP-13B turbojets. Alternatively, a Chinese JL-10A (Type 1492) pulse-Doppler radar with air-to-air and enhanced air-to-surface capabilities could be fitted. The cockpit utilised the HOTAS control principle.

Armament options included up to six PL-5 or PL-9 short-range AAMs, two Russian-

The F-8 IIM demonstrator in strike configuration with bombs on the centreline and FFAR pods under the wings.

The unserialled F-8 IIM prototype in AVIC colours in flight.

The F-8 IIM's cockpit featuring a single monochrome MFD.



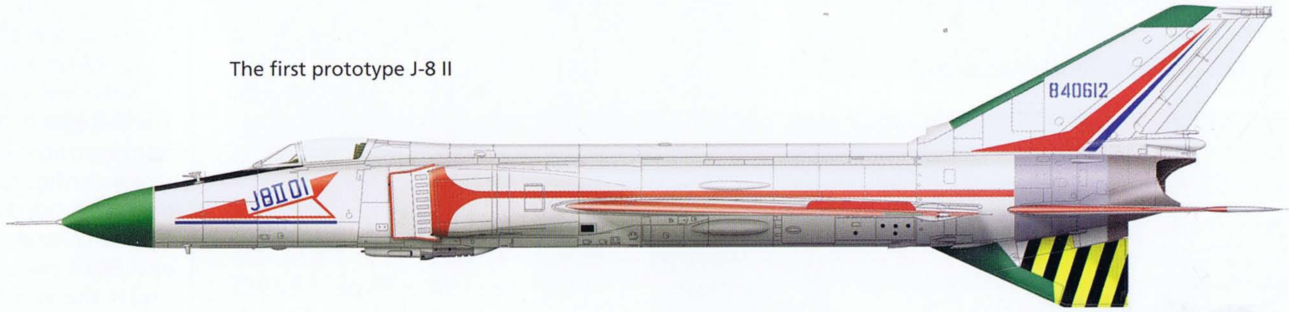
The Phazotron Zhuk 8 IIM fire control radar fitted to the F-8 IIM.

The J-8 II ACT FBW testbed takes off. Note the small canards on the air intake trunks.

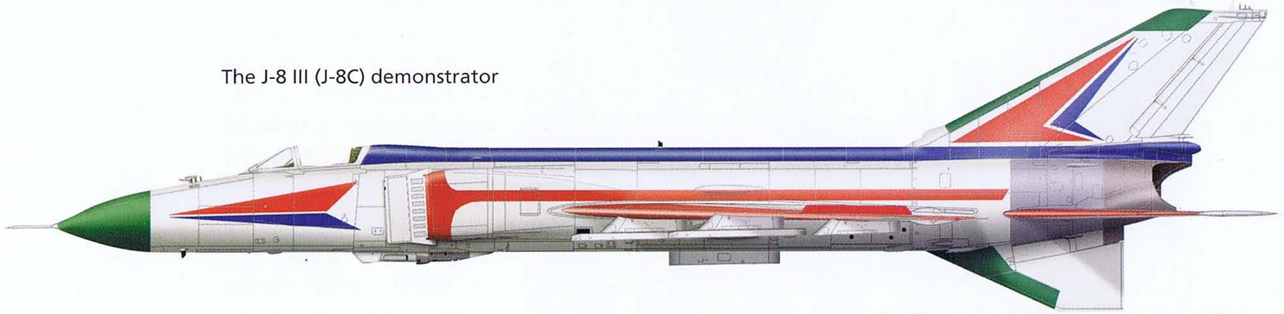
made R-27R1 medium-range SARH AAMs, four Type 90-1 FFAR pods, ten 250-kg bombs, including six on a GDJ-4 multiple ejector rack (a copy of the Russian MBD3-U6-68) on the centreline, or five 500-kg low-drag bombs. Russian Kh-31A supersonic anti-shipping missiles could also be carried.

The unserialled first prototype converted from the original J-8 II prototype entered flight test on 31st March 1996; the flight tests of the aircraft and its powerplant were completed on 19th January 1998. A second F-8 IIM demonstrator was completed by late 1998. Upgrade options proposed for the type include a *Lantian* (Blue Sky) low-altitude navigation pod, a KG 300G self-protection ECM pod, and a triplex digital FBW control system.

The first prototype J-8 II



The J-8 III (J-8C) demonstrator

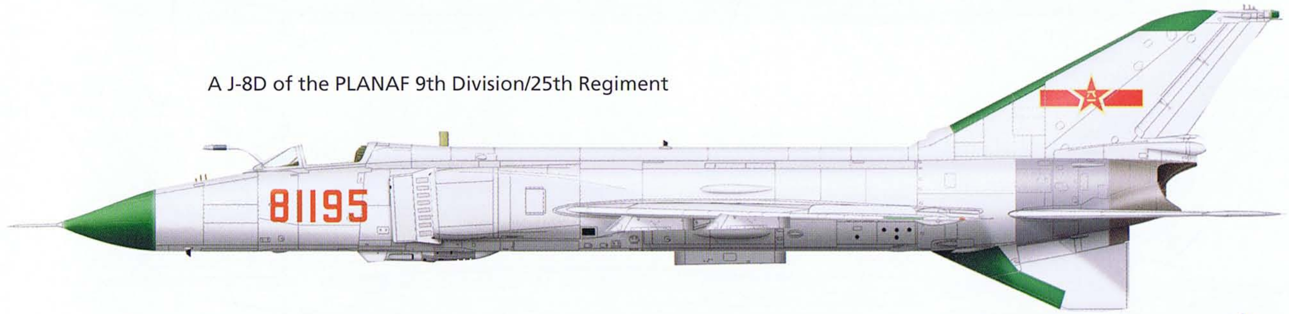


J-8 II ACT control configured vehicle

The ill-starred J-8 ACT testbed was superseded by a converted J-8 II similarly fitted with quad-redundant, three-axis digital FBW controls. The control system included two MIL-STD-1553B-standard flight computers with databus interface. Small canard foreplanes were mounted high on the air intake trunks to induce instability Designated J-8 II ACT, the unserialled aircraft first flew on 29th December 1996; the 49th and final sortie took place on 21st September 1999.

A production J-8 II of the Flight Test & Training Centre/3rd Regiment

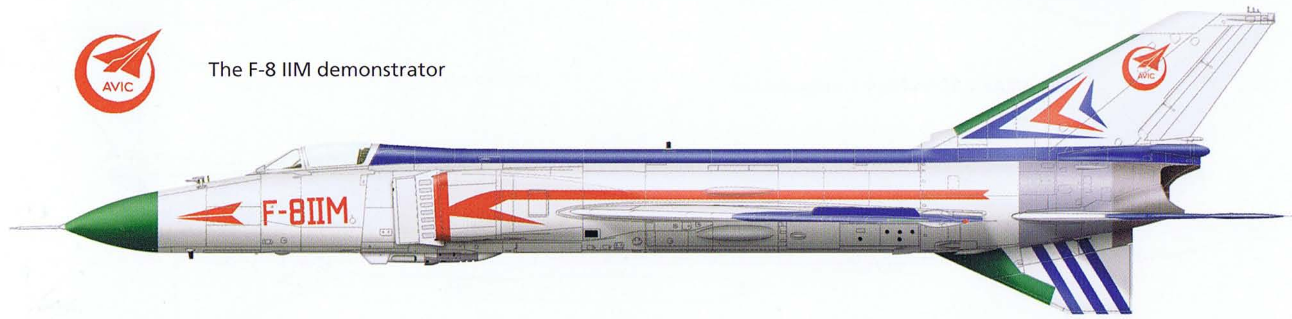
A J-8D of the PLANAF 9th Division/25th Regiment

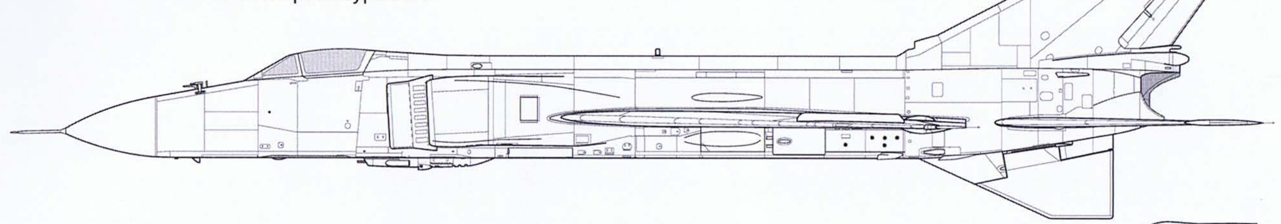


A PLAAF J-8H

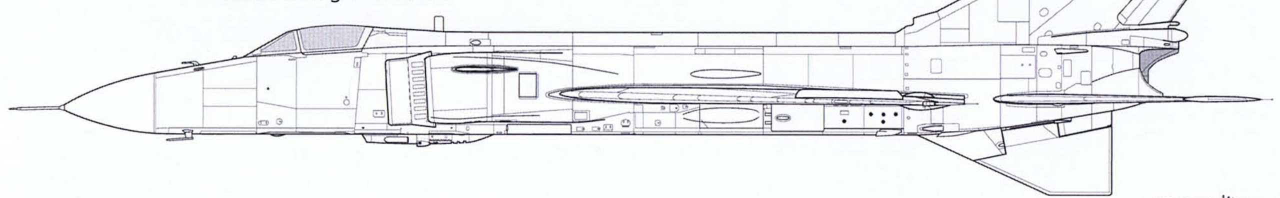
A J-8H of the PLANAF 9th Division/25th Regiment

The F-8 IIM demonstrator

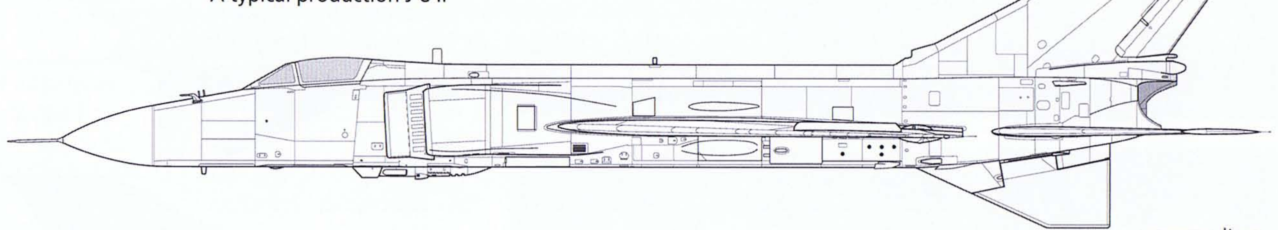




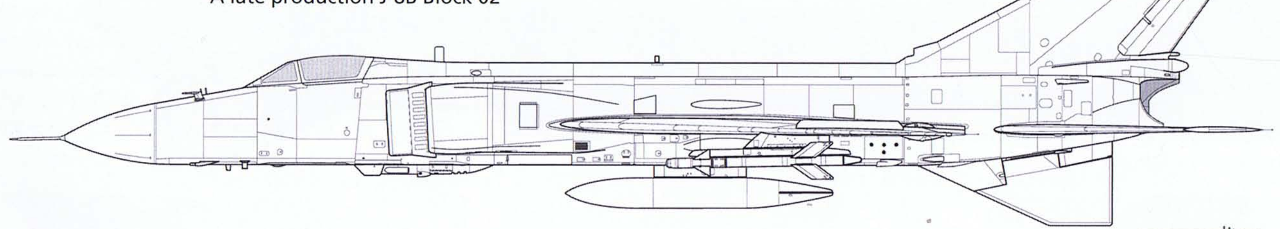
The first prototype J-8 II



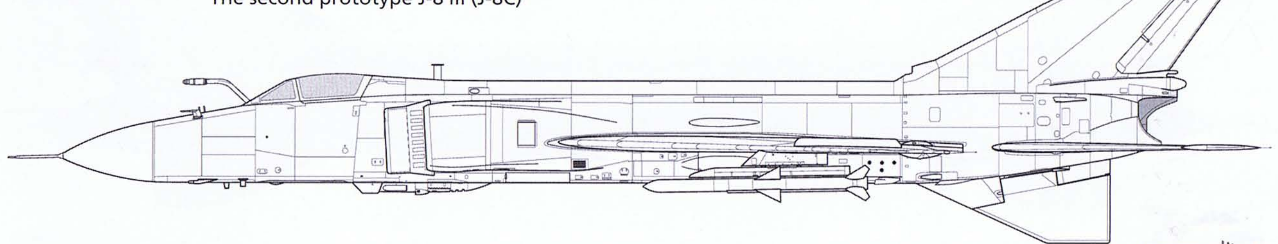
The same aircraft after conversion to the J-8 II ACT control configured vehicle



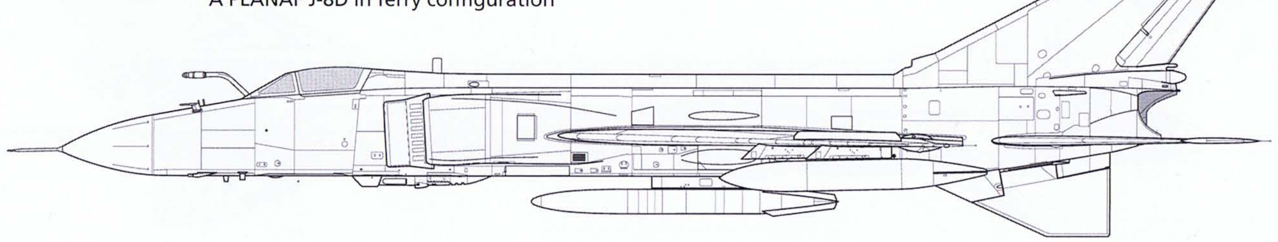
A typical production J-8 II



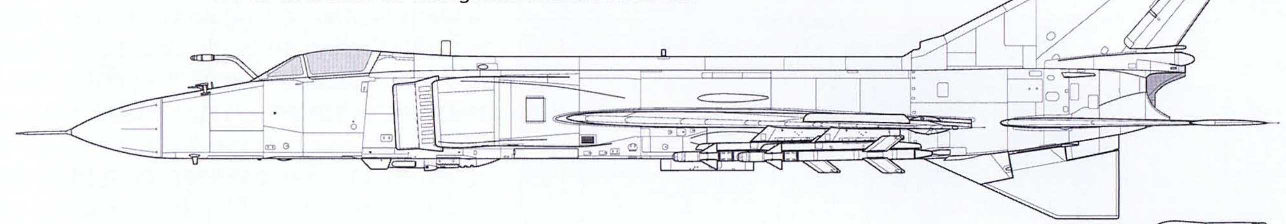
A late production J-8B Block 02



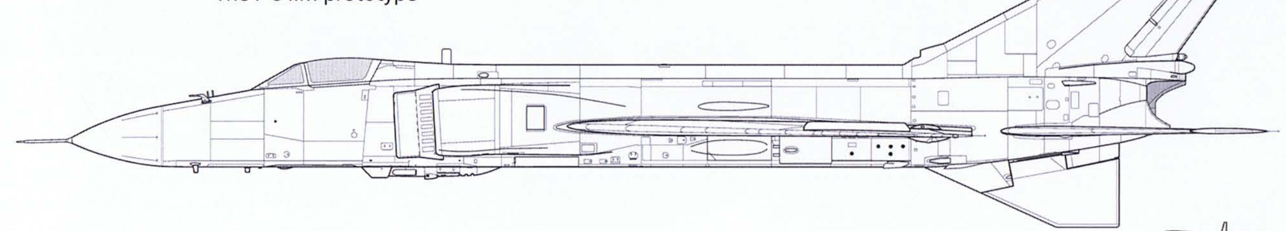
The second prototype J-8 III (J-8C)



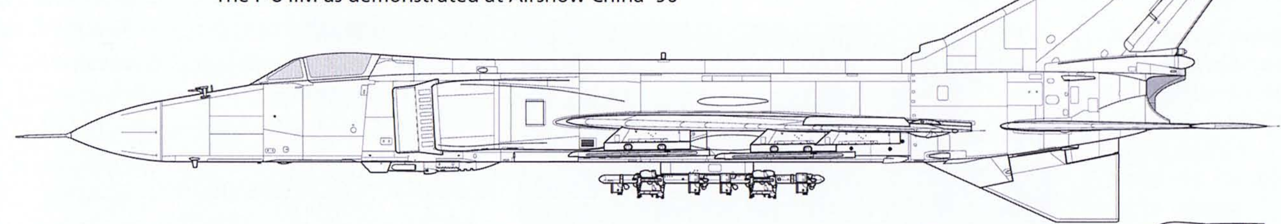
A PLANAF J-8D in ferry configuration



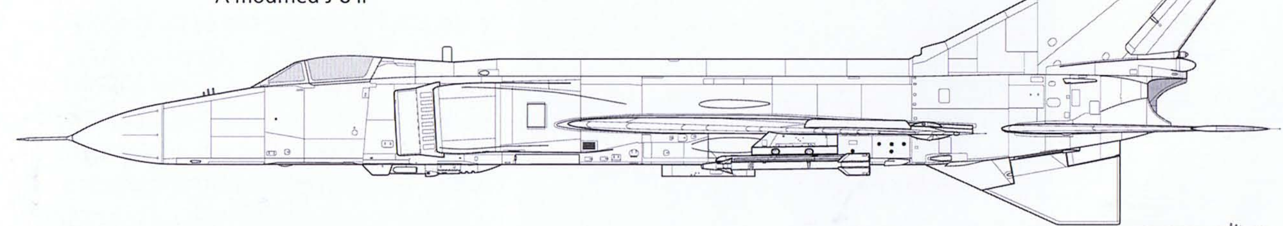
A J-8D in counter-air configuration with PL-8 AAMs



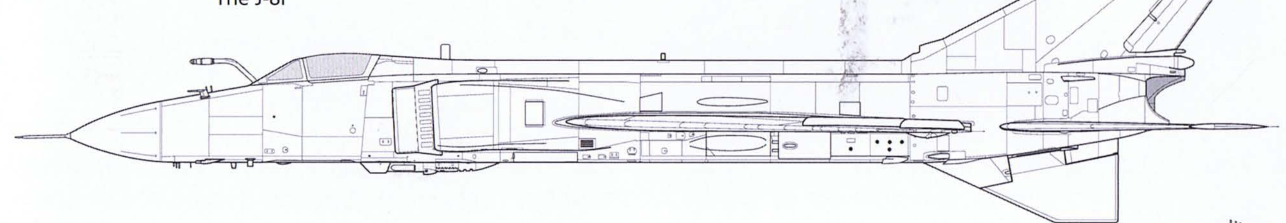
The F-8 IIM prototype



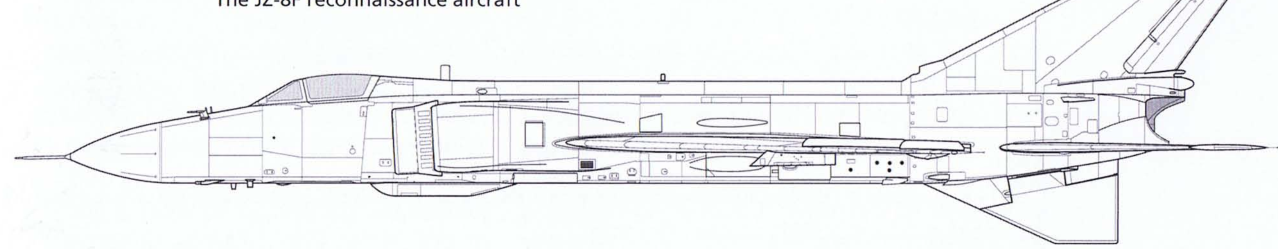
The F-8 IIM as demonstrated at Airshow China '96



A modified J-8 II



The J-8F



The JZ-8F reconnaissance aircraft

Chengdu J-9 tactical fighter (project)

The other concept proposed by the No. 601 Research Institute at the aforementioned conference of 1964 was a project designated J-9. It was a totally different aircraft built around a single afterburning turbofan in the 8,500/12,400-kgp (12,790/27,340-lbst) dry/reheat thrust class. This was a major problem, since no engine in this class existed in China or could be sourced abroad immediately, and there was a considerable risk that powerplant development would lag behind airframe development. On the other hand, the J-9 appeared to offer much higher performance than the J-8, and it was decided to pursue both projects in parallel.

After an MAI conference in Beijing on 12th-17th January 1966 the J-9 programme received official status, and a development

J-8 family specifications

	J-8	J-8 II	F-8 IIM
Powerplant	2 x WP-7A	2 x WP-13A II	2 x WP-13B
Thrust, kgp (lbst):			
dry	2 x 4,400 (9,700)	2 x 4,350 (9,590)	2 x 4,800 (10,580)
reheat	2 x 6,100 (13,450)	2 x 6,600 (14,550)	2 x 7,000 (15,430)
Length:			
less pitot	19.0 m (62 ft 4 1/32 in)	20.53 m (67 ft 4¼ in)	20.53 m (67 ft 4¼ in)
with pitot	21.52 m (70 ft 7¼ in)	21.39 m (70 ft 2¼ in)	21.39 m (70 ft 2¼ in)
Wingspan	9.3 m (30 ft 6 9/64 in)	9.344 m (30 ft 8 in)	9.344 m (30 ft 8 in)
Height	5.2 m (17 ft 0 23/32 in)	5.41 m (17 ft 9 in)	5.41 m (17 ft 9 in)
Wing area, m^2 (sq ft)	40.0 (430.1)	42.2 (454.24)	42.2 (454.24)
Empty weight, kg (lb)	9,240 kg	9,820 (21,650)	10,371 (22,864)
Normal take-off weight, kg (lb)	13,700 (30,200)	14,300 (31,526)	15,288 (33,704)
Maximum take-off weight, kg (lb)	16,580 (36,550)	18,879 (41,621)	18,879 (41,621)
Maximum power loading, kg/kgp (lb/lbst)	1.36	1.40	1.35
Fuel capacity, litres	5,400 (1,188)	n.a.	n.a.
Maximum payload, kg (lb)	2,500 (5,510)	4,500 (9,920)	
Maximum level speed, km/h (mph)	2,450 (1,521)	2,300 (1,428)	2,300 (1,428)
Unstick speed, km/h (mph)	n.a.	325 (202)	330 (206)
Touchdown speed, km/h (mph)	n.a.	290 (180)	300 (186)
Maximum climb rate at sea level, m/sec (ft/min)	n.a.	200 (39,370)	224 (44,094)
Service ceiling, m (ft)	n.a.	18,000 (59,050)	18,000 (59,050)
Combat radius, km (miles):			
without IFR/with 3 drop tanks	n.a.	800 (496)	1,000 (621); 600 (372);
with one refuelling	–	1,200 (754)*	900 (559)**
T-O run with afterburning, m (ft)	n.a.	670 (2,200)	630 (2,070)
Landing run, brake parachute deployed, m (ft)	n.a.	1,000 (3,280)	900 (2,955)
G limit in sustained turn at 5,000 m (16,400 ft)	n.a.	+4.83	+4.7
Armament: cannons	2 x Type 30-1 cannons	1 x Type 23-III cannon	1 x Type 23-III cannon
missiles	2 x PL-2B	4 x PL-2B, PL-5B/C/E	4 x PL-2B, PL-5B/C/E, PL-8 2 x R-27R1 2 x Kh-31A
unguided weapons	–	250-/500-/1,000-kg free-fall bombs 57-mm or 90-mm FFARs	250-/500-/1,000-kg free-fall bombs 57-mm or 90-mm FFARs

* J-8D

** air-to-air interception at 11,000 m (36,080 ft) with 5 min combat; combat air patrol, including 10 min patrol and 5 min combat; ground attack, out and back at 10,000 m (32,800 ft), including 5 min combat

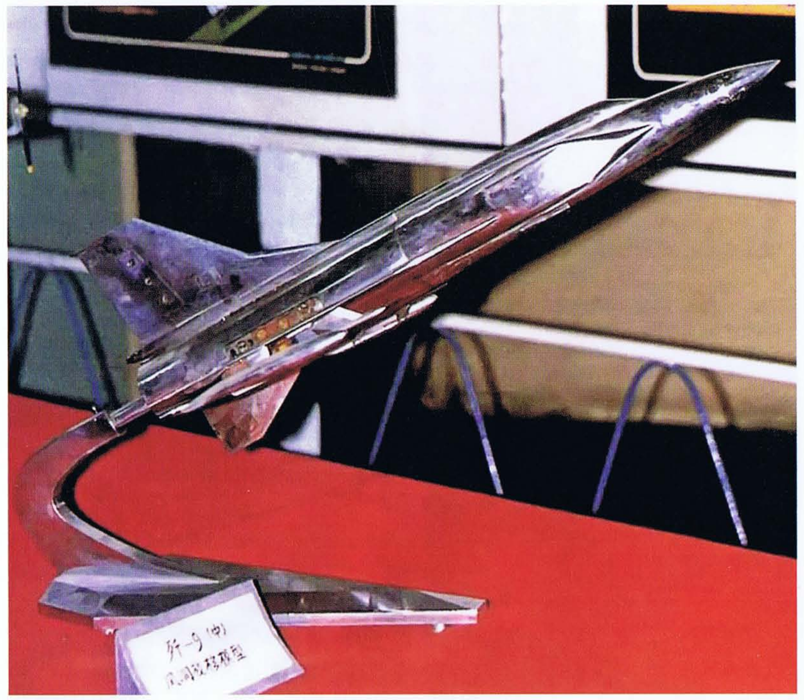
schedule was approved on 12th April that year. The target performance figures included a maximum take-off weight of 14,000 kg (30,860 lb). Two operational concepts were explored; one was an air superiority fighter with a secondary strike role having a top speed of Mach 2.3-2.4 at 20,000 m (65,620 ft) and a combat radius in excess of 450 km (280 miles). The other one was a pure interceptor having a top speed of Mach 2.5 at 22,000 m (68,900-72,180 ft) and a combat radius in excesss of 350 km (217 miles).

In 1965 the No. 601 Research Institute prepared four preliminary design projects – two swept-wing designs with wings swept back 50° and 55° at quarter-chord, a version with double-delta wings swept back 50° and a pure delta with 57° wing sweep. A new operational requirement was handed down on 1st April 1966, specifying a combat radius in excess of 600 km (372 miles), an endurance of three hours and a maximum climb rate of 180-200 m/sec (35,420-39,360 ft/min). Initially the designers went ahead with the so-called J-9A-IV – a tailed delta with two-dimensional lateral air intakes and a large ogival radome (similar to the future J-8 II). Yet it turned out that the tailed-delta configuration did not ensure the required performance and manoeuvrability, and the J-9A was dropped in favour of the J-9B-V version featuring a tailless-delta layout with 60° leading-edge sweep and a wing area of 62 m^2 (666.66 sq ft).

Then came a pause caused by the 'Cultural Revolution'; only in 1968 was it decided to resume the work on the J-9B-V with the intention to fly the first prototype by October 1969, timing the event to the PRC's 20th anniversary. Yet the major development problems facing the designers had not been resolved by early 1969, and the Ministry of Aircraft Industry put the J-9B-V on hold – only to revive the previously cancelled J-9A-IV! The originally selected Plant No. 112 in Shenyang had its hands full with the J-8, so the J-9 programme was assigned to the new Plant No. 132 in Chengdu and the No. 611 Research Institute, which was to complete development of the fighter. Shounan Wang was appointed project chief at this stage.

But the J-9 was not out of the woods yet. On the contrary, on 9th June 1970 the Chinese MoD altered the SOR *again*, demanding high manoeuvrability and a combat radius of 900-1,000 km (559-621 miles). The J-9 was now to have a TOW of 13,000 kg (28,660 lb) and a top speed of Mach 2.5 at 25,000 m (82,020 ft) – which, at the insistence of the PLAAF command, was amended in November 1970 to Mach 2.6 at 26,000 m (85,300 ft).

The J-9A-IV could not meet this new target, so it was 're-killed' – this time for good. Instead, the designers reworked the tailless J-9B-V and came up with a new configuration called J-9B-VI. This aircraft bore a certain resemblance to the SAAB J-37 Viggen, utilising a canard-delta layout with lateral intakes; a single ventral intake was also considered. the



A desktop model of the projected J-9 fighter in its ultimate J-9B-VI configuration. Note the double-delta wings.

high-set canard foreplanes of delta planform were all-movable, with a leading-edge sweep of 55° and a total area of 5.7 m² (61.29 sq ft); wing sweep and wing area were 60° and 50 m² (537.6 sq ft). The powerplant was a WS-6 (Type 910) afterburning turbofan rated at 12,490 kgp (27,530 lbst). However, because of the ongoing development problems with this engine the Soviet Khachaturov R29-300 afterburning turbojet rated at 8,300 kgp (18,300 lbst) dry and 12,500 kgp (27,563 lbst) reheat was chosen as an alternative powerplant, to be reverse-engineered as the WS-15.

When Deng Xiaoping came to power in 1975, the SOR for the J-9 was finalised in February, envisaging a top speed of Mach 2.5 at 23,000 m (75,460 ft), a range of 2,000 km (1,240 miles) and a climb rate of 220 m/sec (43,300 ft/min). The fighter was to be armed with four PL-4 AAMs with infrared or semi-active radar homing; the fire control system was built around the Type 205 radar with a detection range of 70 km (43.5 miles) and a tracking range of 52 km (32.3 miles).

In November 1975 the State Planning Commission allocated funds for the construction of five prototypes, the maiden flight being planned for late 1980 or early 1981. Yet in 1980 the programme was finally terminated.

Shenyang J-10 heavy interceptor (project, first use of designation)

Very little is known about this interceptor, which was under development in the 1970s. The only evidence is a desktop model depicting a large twin-turbofan tailless-delta aircraft with shoulder-mounted wings and outward-canted twin tails augmented by ventral fins. The tandem cockpits (the rear one apparently being for the weapons systems operator) and the raked two-dimensional air intakes bore a strong resemblance to those of the MiG-31 heavy interceptor (NATO reporting name *Foxhound*).

Shenyang J-11 light fighter (project, first use of designation)

Taking due account of the Vietnam War experience of operating fighters from ad hoc 'ambush airstrips' to intercept US strike aircraft formations, in 1969 the PLAAF posed a requirement for a light tactical fighter having short take-off and landing (STOL) capability. The aircraft was to be a replacement for the obsolescent J-6 and, to a certain extent, the Q-5 attack aircraft.

Working together with the No. 601 Research Institute, the Shenyang Aircraft Factory explored three alternative concepts. The first one envisaged a powerplant of two uprated WP-6 III afterburning turbojets; however, this engine was getting long in the tooth and may not have provided the required speed. The second version was built around a single WP-7 III afterburning turbojet; however, with the specified maximum take-off weight of 7,000 kg (15,430 lb) the thrust/weight ratio would be marginal, severely limiting the fuel load and ordnance load.

The third concept was based on an afterburning turbofan which did not yet exist. The designers proposed developing an afterburning version of the Rolls-Royce Spey 512 powering the Hawker Siddeley HS.121 Trident airliner. After a lengthy appraisal the third concept was selected for further development of a fighter designated J-11.

Preliminary development was completed in late 1971, and the resulting aircraft bore a striking resemblance to the French Dassault Mirage F1. It had sharply swept shoulder-mounted wings with a leading-edge dog-tooth; the conventional tail surfaces featured low-set stabilators and a small ventral fin. The single engine breathed through semi-circular lateral intakes with half-cone centrebodies. The long pointed nose was to house a Type 645 fire control radar. The armament consisted of two 30-mm cannons and up to four PL-2 or PL-5 AAMs, or air-to-surface weapons.

The J-11 was to be 15.76 m (51 ft $8\frac{15}{32}$ in) long and 4.7 m (15 ft $5\frac{3}{64}$ in) high, with a wing span of 8.695 m (28 ft $6\frac{21}{64}$ in) and a normal TOW of 8,700 kg (19,180 lb). The aircraft was to have a take-off run of only 500 m (1,640 ft), a range of 2,300 km (1,430 miles) and a maximum climb rate of 197 m/sec (38,770 ft/min) at 5,000 m (16,400 ft).

The project did not materialise – for several reasons. Firstly, the intended powerplant proved unobtainable – it was impossible to purchase more Spey 512s or reverse-engineer the engine at that stage. Secondly, the competing J-12 project was much more advanced in its development. Hence the J-11 programme was terminated, the designation being reused much later for a Sukhoi Su-27SK derivative – ironically, also built by Shenyang.

Nanchang J-12 light fighter

A competing design under the same programme was offered by the Nanchang Aircraft Factory. The aircraft was designated J-12. Lu Xiaopeng, Vice-Director of the factory's design department, was the project chief.

The J-12 resembled a scaled-down version of the North American F-100 Super Sabre with some typical MiG features incorporated. The moderately swept wings were low-set, featuring a kinked trailing edge and a single tall boundary layer fence on each side at two-thirds span; the tail unit comprised a sharply swept trapezoidal fin (plus a ventral fin) and low-set moderately swept stabilators. The aft-hinged canopy with a wraparound windshield was faired into a shallow fuselage spine. The single 4,050-kgp (8,930-lbst) WP-6B non-afterburning turbojet housed in the rear fuselage breathed through a circular nose intake similar to that of the MiG-19 but having sharp lips. The nose gear unit retracted forward, the main units inward into the fuselage (the landing gear was similar to that of the J-6). The armament consisted of two 30-mm cannons buried in the wing roots.

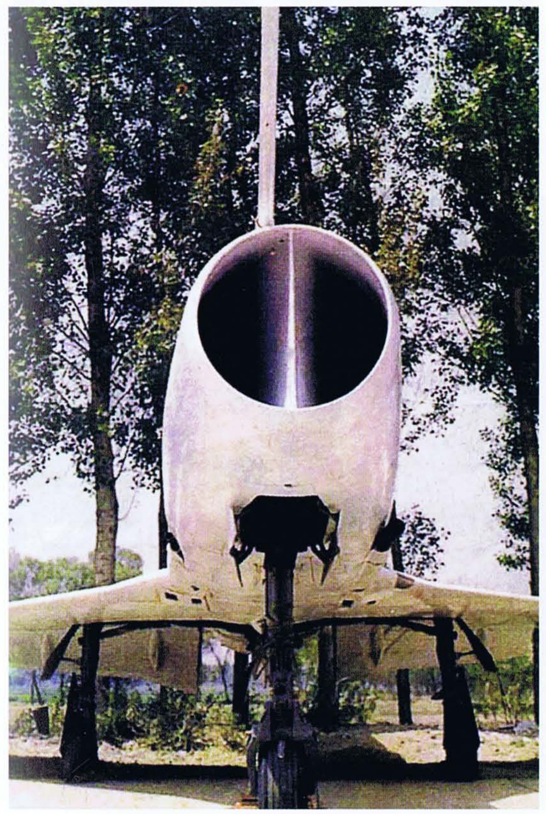
In contrast with the J-11, the normal take-off weight was a mere 4,550 kg (10,030 lb). This was due to the aircraft's small dimensions and to the large-scale use of titanium alloy, chemical milling and honeycomb structures. Thus, the J-12 was not just a light fighter but a bantam fighter.

The work proceeded at a remarkably fast pace. Development began in July 1969; the concept was finalised in August 1969 and prototype manufacturing started at the end of the year. Serialled '01 Red', the first prototype made its maiden flight on 26th December 1970; it was followed by the second prototype ('02 Red') and a static test article.

The tests ran surprisingly smoothly and the results were generally encouraging; the aircraft was more agile than the J-6. On 10th September 1973 the J-12 was demonstrated to senior Chinese politicians and military officials at Nan Yuan airbase near Beijing.

The original version was 10.644 m (34 ft $11\frac{3}{64}$ in) long less pitot and 3.706 m (12 ft $1\frac{29}{32}$ in) high, with a wing span of 7.192 m (23 ft $7\frac{5}{32}$ in) and a wing area of 16 m² (172 sq ft). The empty weight was 3,172 kg (6,993 lb) and the maximum TOW was 5,295 kg (11,673 lb). Maximum level speed at 11,000 m (36,090 ft) was 1,472 km/h (914 mph), the service ceiling was 16,870 m (55,350 ft), the maximum rate of climb was 180 m/sec (3,540 ft/min) and the maximum range on internal fuel was estimated as 1,167 km (725 miles). The take-off run was 450 m (1,480 ft).

Three aspects of the J-12 fighter, showing the original non-adjustable intake, the wing shape and the large flaps.



J-12 I '7112 Red' shows the revised air intake with a shock cone and the low-set pitot.

J-12 I '145 Red' jacked up for gear checks.

This J-12 acting as a gate guard at the PLAAF Museum combines a high-set pitot with an inlet centrebody.

J-12 I (J-12A) light fighter

The customer was dissatisfied with the fighter's performance, demanding improvements. Hence the Nanchang Aircraft Factory undertook a redesign of the J-12. Occasionally referred to as the J-12 I or J-12A, the revised fighter had an area-ruled fuselage and a new air intake featuring a fixed shock cone similar to that of the J-7; this increased the overall length less pitot to 10.665 m (34 ft 11⅞ in). The pitot boom on top of the nose was relocated to a ventral position, folding upward to avoid ground damage (likewise in the manner of the J-7). Provisions were made for carrying two PL-2 AAMs.

Again, three J-12s were built in the new configuration, including '145 Red' and '7112 Red'. The 'second maiden flight' took place in July 1975; by January 1977 the J-12 I had logged 61 hours 12 minutes in 135 test flights. A top speed of Mach 1.386 and a service ceiling of 17,410 m (57,120 ft) were reached. Yet it was clear that the lightly armed J-12 with its relatively low performance would be unable to offer serious opposition to contemporary strike aircraft. Therefore in February 1978 the government finally pulled the plug on the programme.

Shenyang J-13 light fighter (project)

Unlike the fighters described previously, this project was developed by the Shenyang Aircraft Co. as a private initiative. At the turn of 1971/72 the No. 601 Research Institute tasked SAC with holding a survey in 1972 in order to find out what kind of aircraft the Air Force and Navy wanted. The survey, which involved 12 PLAAF and PLANAF units, continued until late 1974. In early 1974 SAC also began probing the PLAAF leadership with a view to promoting their concept. As a result of this preparatory work a formal operational requirement for a fighter designated J-13 was issued on 24th April 1976.

Apart from creating a multi-role combat aircraft able to compete with state-of-the-art foreign designs on the world weapons market, the designers at Shenyang apparently strove to get ahead of their competitors from Chengdu developing the J-9. Unfortunately they ran into the same technical problems as the competitors, the greatest problem being the lack of a suitable engine. Since the requirements to which the two fighters were being developed were basically identical, so were the proposed engines – the WS-6 was considered the first choice in June 1976, with the WS-9 (Rolls-Royce Spey 202) as an option. Later, the R29B-300 also came into consideration.

Large-scale research was done on the fighter's layout, about 20 possible configurations being considered and more than 3,000 wind tunnel hours being logged from early 1973. Known configurations show a single-engined aircraft with shoulder-mounted wings and a conventional tail featuring either small lateral air intakes or a single large ventral intake; the latter gave rise to the nickname 'Chinese F-16' when information about the project leaked into the Internet much later. Anyway, the powerplant issue was never resolved and in May 1981 the government finally cancelled the J-13 programme.

Chengdu J-10 (F-10) multi-role fighter (second use of designation)

The Chengdu J-10 is one of China's most ambitious fighter programmes – and one of the most controversial too. The story of this aircraft began when the No. 611 Research Institute in Chengdu launched Project 8810 – a fourth-generation fighter intended as a successor to the J-7 and, to a certain extent, the Q-5. The need for such an aircraft was becoming increasingly acute, considering that the previous Chinese tactical fighter projects (the J-9, J-11 and J-13) had come to nothing. Initially the J-10 was to be an air superiority fighter designed to oppose the then-latest Soviet fighters – the Mikoyan MiG-29 (NATO reporting name *Fulcrum*) and Sukhoi Su-27 (NATO reporting name *Flanker*). This should come as no surprise, as Sino-Soviet relations were still somewhat strained at the time.

China did its best to keep the J-10 secret, and until recently very little was made public about this programme, giving rise to conflicting reports. Thus, the programme launch date has been reported as 1984 (which makes sense, considering the cancellation dates of the preceding projects), 1986 or even October 1988.

As mentioned earlier, the J-9 had utilised a canard delta layout with a single afterburning turbofan, and the designers at Chengdu chose to retain this layout for the J-10. An early version of the project featured Mirage-style semi-circular lateral intakes with half-cone centrebodies, but these were soon rejected.

Whilst the fighter's general arrangement was being defined, help came from Israel. In 1980-87 the latter country had developed its own fourth-generation fighter – the IAI Lavi (Young Lion). This aircraft, which was based on F-16 technology, first flew in 1986 but eventually the programme was cancelled for various reasons. The Lavi utilised a canard delta layout, featuring a blended wing/body (BWB) design with a single chin air intake. When the first pictures of the J-10 became available in the mid-1990s, showing a strong similarity to the Lavi, Israel strongly denied that technology transfer had taken place. So did China at first (albeit probably for different reasons); yet the two nations had co-operated in defence matters since the early 1980s, and the

The second prototype J-12 is also on display at the PLAAF Museum.

'1001 Red', the first prototype of the J-10 fighter, in the Chengdu Aircraft Company hangar.

A 'toad's eye view' of the second prototype ('1002 Red'), showing the narrow wheel track.

The first prototype out in the open, with parts of the airframe still in primer.

Lavi clearly had an influence on shaping the outlook of the Chinese fighter. Not until 1995 was the transfer of the Lavi's design documents to China officially admitted.

True enough, the J-10 was no carbon copy of the Lavi after all. The Chinese aircraft was larger; its wing planform was different, with a kinked leading edge and no trailing-edge sweep, and the canards were set higher. Unlike the Israeli fighter, which had a fixed-area air intake of quasi-elliptical cross-section, the J-10 featured a two-dimensional variable air intake. Also, the two aircraft were developed to meet different requirements. The Lavi was optimised for strike missions, with air superiority as a secondary role; with the J-10 it was vice versa.

The aircraft was meant to be on a par with western and Russian fourth-generation fighters. To this end the designers incorporated a Type 634 quadruplex digital FBW control system (tested on the J-8 II ACT) and a 'glass cockpit' with a wide-angle HUD and four MFDs. The fighter utilised the HOTAS principles. The large bubble canopy provided the pilot with a 360° field of view; the pilot sat on a TY-6 zero-zero ejection seat.

From the start the programme was affected considerably by political factors, which necessitated design changes and caused delays. Until 1989, the Chengdu Aircraft Co. had hoped to use western engines and avionics; yet the Tiananmen Square events of 1989 and the ensuing embargo made this impossible. The designers had to seek alternative powerplants, eventually turning to Russia for help, since the Sino-Russian relations were back to normal by then. The choice fell on the Lyul'ka-Saturn AL-31F afterburning turbofan rated at 7,850 kgp (17,305 lbst) dry and 12,500 kgp (27,560 lbst) reheat – the engine powering the Su-27 family. An immediate problem arose: the engine had a dorsally mounted accessory gearbox, which proved inconvenient for a single-engined aircraft. Lyul'ka-Saturn responded by developing the AL-31FN version featuring a ventral accessory gearbox specially for the J-10 and assisted with the engine/airframe integration.

With the serial amended to '01 Red', the first prototype shows its undersides during a flypast. Note the cannon offset to port and the twin ventral fins.

J-10 '1001 Red' in its latest guise with conformal fuel tanks. The aircraft carries five laser-guided bombs and a laser designator pod under the air intake.

Speaking of engines, Russia refused to sell China licence manufacturing rights for the AL-31F engine, striving to prevent exports of J-11 fighters (licence-built Su-27SKs) that would be a breach of the licensing agreement. Thus, the engines for both the J-11 and the J-10 were to be supplied by Russia, with at least 300 engines earmarked for the latter type. Not to be outdone, the Liming Motor Co. engine factory in Shenyang brought out a turbofan designated WS-10A Taihang afterburning turbofan – a derivative of the AL-31F.

The avionics house Phazotron became another Russian partner, offering its Zhuk-10 (Beetle) and RP-35 Zhemchug (Pearls) multimode X-band (8 to 12.5 GHz) radars as alternatives to the Elta EL/M-2035 (which, incidentally, had been used on the Lavi). However, CAC also eyed the indigenous JL-10 (Type

'1003 Red', the third prototype, about to become airborne. Note the deflected leading-edge flaps.

Another view of '1003 Red', showing the trailing-edge flaps and flaperons.

Still-unpainted production J-10s seen during pre-delivery tests. '01 Red' is the first production machine.

Two more early production J-10s. '05 Red' carries dummy PL-8 AAMs.

1473) radar developed by the Laiyang Electronic Technology Research Institute (LETRI). The latter model was capable of tracking ten targets while attacking priority threats; the maximum detection range was estimated as 100 km (62 miles).

An all-metal full-size mock-up was completed by late 1993. Yet, wind tunnel tests revealed potential problems with low-speed performance and lower-than-expected maximum AoAs at subsonic speeds. Besides, in the course of the design process the J-10 was transformed from a pure fighter to a multi-role combat aircraft, which caused some redesign and consequent delays. Finally, in the light of the new situation American fighters, not Russian ones, were now viewed as the J-10's main adversaries. This led CAC to redesign the fighter.

In keeping with its new role the J-10 was to carry air-to-air and air-to-surface weapons on 11 hardpoints. The weapons included PL-8 short-range AAMs, PL-11 and PL-12 (SD-10) medium-range AAMs, C-701 anti-radar missiles, free-fall bombs and laser-guided bombs. Russian missiles, such as the R-73 short-range AAM, R-77 (RVV-AE) medium-range AAM and Kh-31 ASM, could be carried potentially if the Zhuk-10 radar was selected.

A dozen prototypes took part in the trials – both in Chengdu and at the China Flight Test Establishment (CFTE) in Yanliang. The first aircraft ('1001 Red') reportedly took the the air in mid-1996. J-10 '1002 Red' was the first to have a full set of mission avionics. Tragically, this aircraft crashed fatally in late 1997 due to a control system failure. A long hiatus followed, and the next prototype ('1003 Red') did not join the tests until 23rd March 1998; it was used for verifying the FBW control system. The fourth single-seater ('1005 Red') served for systems compatibility trials and weapons tests. '1006 Red' was jointly operated by the No. 606 Research Institute and the Liming Motor Co., being fitted with a fixed IFR probe on the starboard side.

In 2000 the J-10 completed its trials programme. In late 2001 the Chengdu factory took delivery of the first batch of 54 AL-31FN engines for production aircraft. The first pre-production machine took to the air on 28th June 2002. In August that year the type reportedly achieved initial operational capability with the PLAAF, when full-scale production began at Chengdu. In 2003 the J-10 was cleared for full squadron service.

Some US experts deem the J-10 to be on a par with such fourth-generation fighters as the Dassault Rafale, BAe/SAAB JAS 39 Gripen, Eurofighter Typhoon, Lockheed Martin F-16 and Boeing F/A-18E/F Super Hornet as far as agility is concerned.

J-10A single-seat fighter

The basic single-seat fighter version currently in service is designated J-10A. 50 to 70 examples have been delivered to the PLAAF so far.

The following estimated figures for the J-10A have been released. The aircraft is

Four operational J-10As of the PLAAF 3rd Division are towed at Changxing AB.

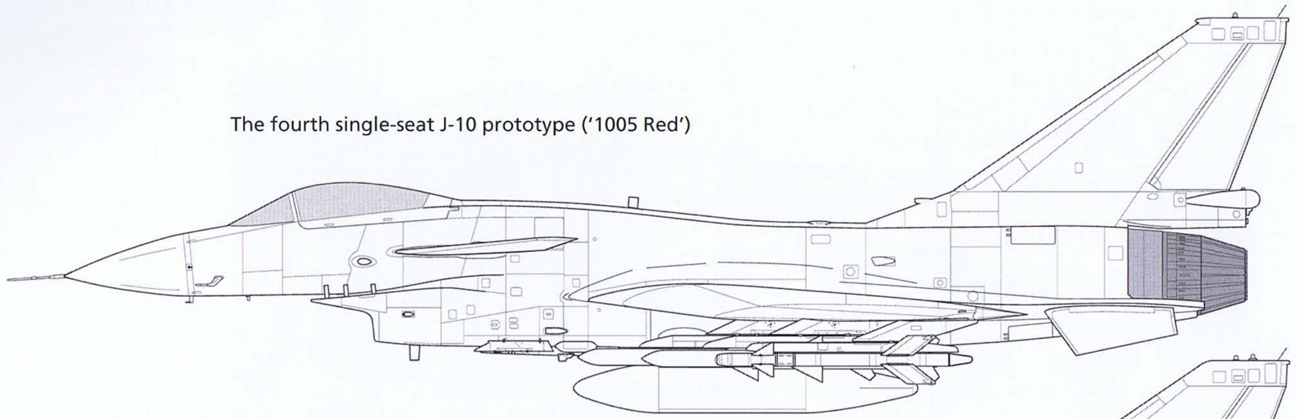
14.57 m (47 ft 9½ in) long and 4.78 m (15 ft 8¼ in) high, with a wing span of 8.78 m (28 ft 9¾ in). The area of the wings and the canards is 33.1 m² (356.3 sq ft) and 5.45 m² (58.66 sq ft) respectively. The J-10A has an empty weight of 9,750 kg (21,495 lb), a fuel load of 4,500 kg (9,921 lb) and an identical ordnance load, all of which adds up to a maximum take-off weight of 18,500 kg (40,785 lb). The fighter can reach a top speed of Mach 1.85 at high altitude and Mach 1.2 at sea level. The service ceiling is 18,000 m (59,050 ft), the combat radius 463-555 km (287-345 miles) and the ferry range 1,850 km (1,150 miles).

J-10S combat trainer

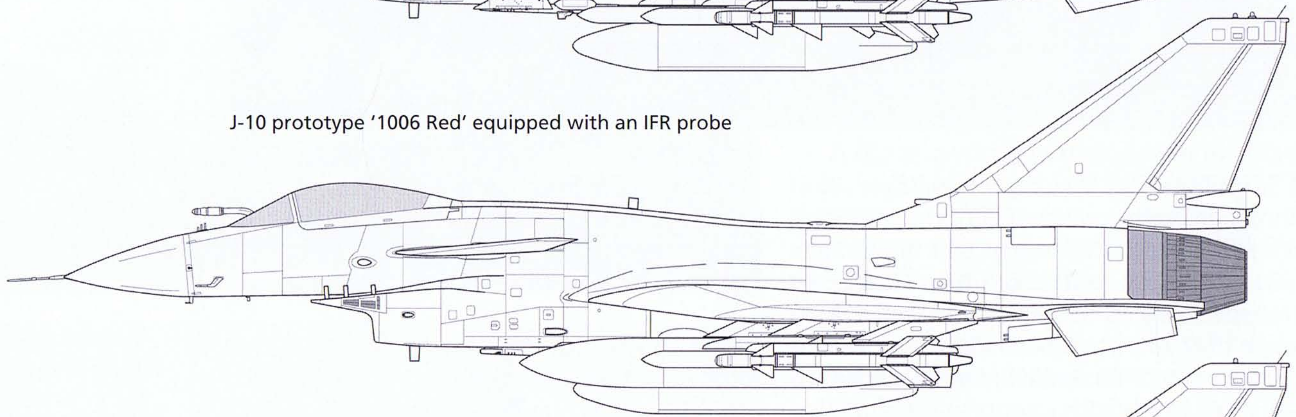
Realising the complexity of the new fighter type, CAC developed a two-seat combat trainer variant designated J-10S (*Shuangzuo* – two-seater). The trainee and instructor sat in a stepped-tandem arrangement under a common aft-hinged canopy. The aircraft retained full weapons capability and a full avionics fit.

An impressive line-up of J-10As, including '10741 Yellow', at Changxing.

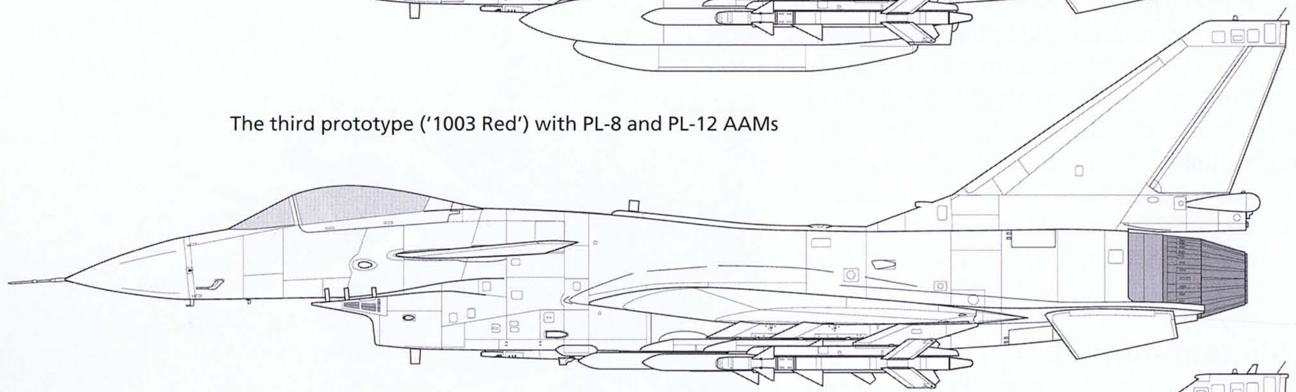
'March, brothers, march.' A typical Chinese publicity shot taken at the same J-10 unit.



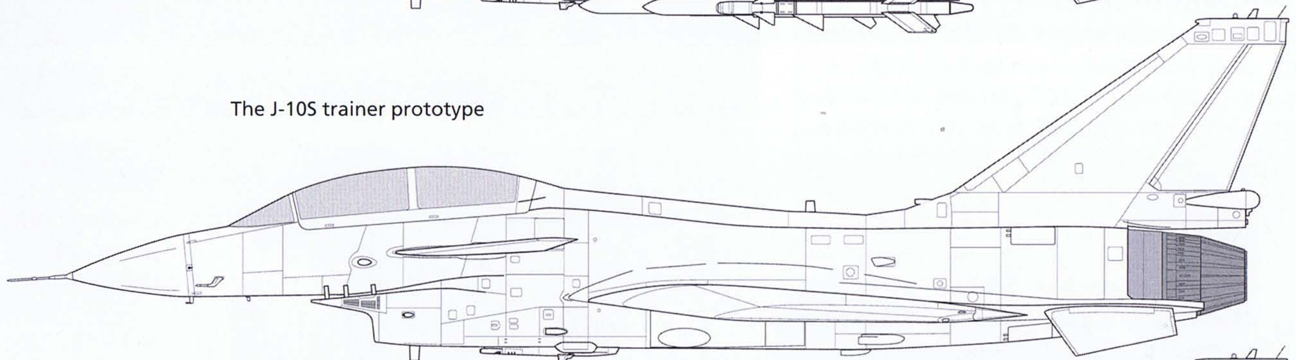
The fourth single-seat J-10 prototype ('1005 Red')



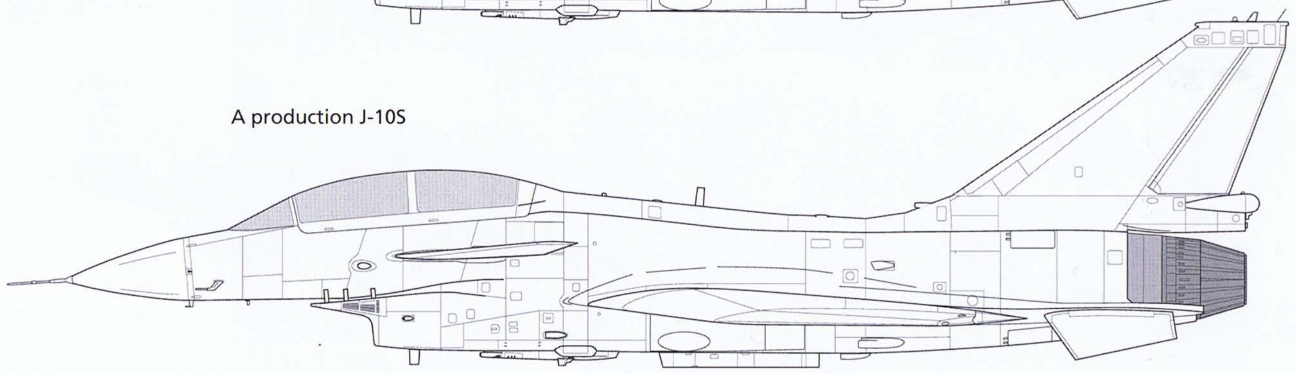
J-10 prototype '1006 Red' equipped with an IFR probe



The third prototype ('1003 Red') with PL-8 and PL-12 AAMs



The J-10S trainer prototype



A production J-10S

J-10 '1006 Red' was fitted with a fixed IFR probe. Here it is seen with a full load of PL-8 AAMs.

'1013 Grey', a pre-production J-10 used in the test programme.

The fourth prototype, '1004 Red', was completed as the first two-seater, making its maiden flight on 26th December 2003. Flight tests were completed in 2005 and the J-10S entered squadron service in 2006, being deployed alongside the single-seater.

J-10B fighter

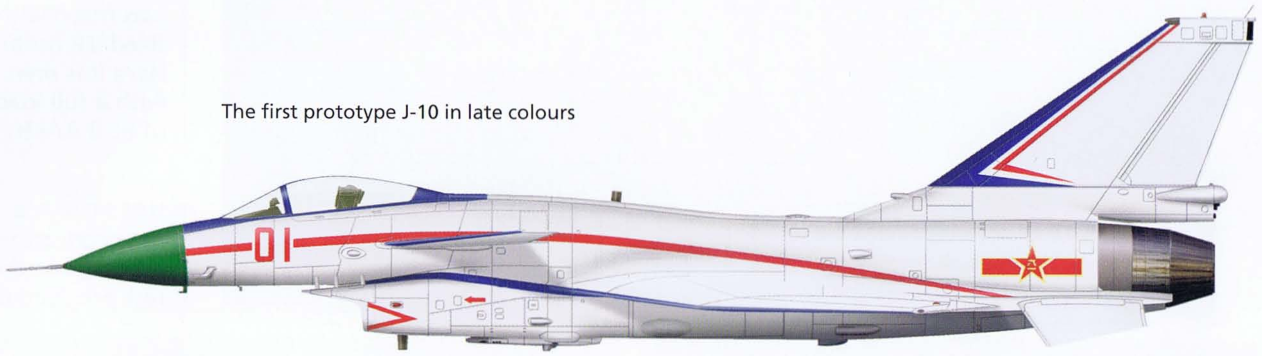
An upgraded version designated J-10B was reported in early 2006. This fighter differs from the J-10A in having an uprated AL-31FN-M1 engine with a fully controllable thrust-vectoring nozzle, structural reinforcements and a new passive phased-array radar.

J-10 '1018 Grey' features two extra fuselage pylons allowing it to carry six AAMs and three drop tanks.

Two aspects of a production J-10 armed with PL-9 (outboard) and PL-12 AAMs.

An evening scene on the flight line at Changxing AB.

The first prototype J-10 in late colours

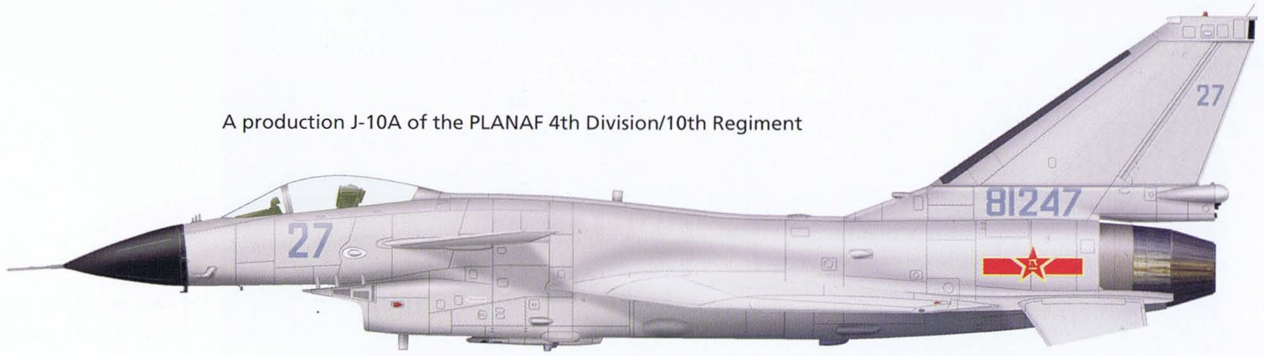


A production J-10A used as a demonstrator by AVIC I

The fifth single-seat prototype J-10 for IFR capability tests

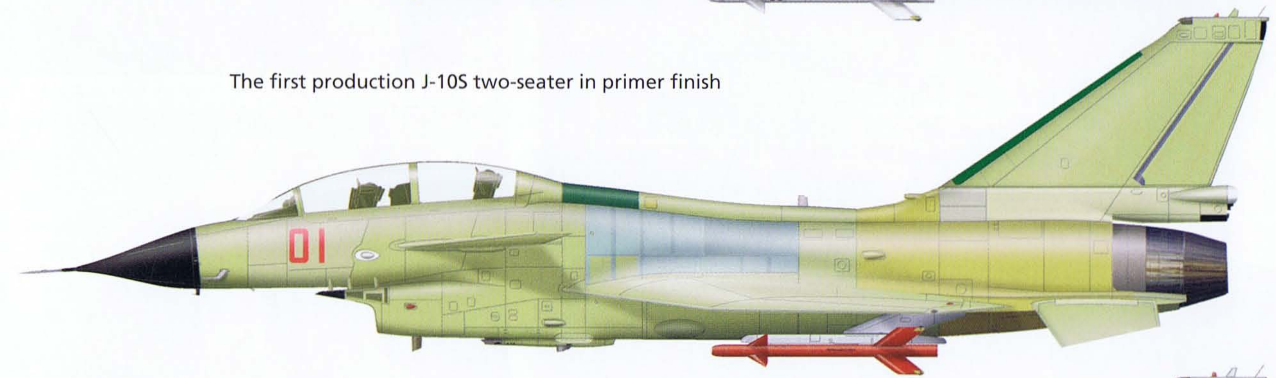
A pre-production J-10A taking part in the trials

A production J-10A of the PLANAF 4th Division/10th Regiment



A J-10A operated by the PLAAF 35th Division, Guangzhou Military Region

The first production J-10S two-seater in primer finish



A J-10S (or J-10AS?) used in the trials programme

A J-10S (or J-10BS?) operated by the PLAAF

J-10AS and J-10BS two-seat fighters

There have been reports of two new advanced versions of the J-10 designated J-10AS and J-10BS. While no details have been released yet, the S suffix indicates these are two-seat versions – possibly multi-role combat aircraft in which the back-seater acts as the weapons systems operator.

J-10 projected versions

In late 2002 it was revealed that CAC and the No. 611 Research Institute had completed conceptual design work on two advanced variants of the J-10; one single- and one twin-engined, both having twin vertical tails and embodying stealth characteristics. Both also featured a redesigned and more angular nose.

A shipboard version of the J-10 is also said to be under development. Such an aircraft

'01 Red', the first production J-10S trainer.

'1021 Red', one of the two-seaters involved in the trials.

The J-10 has a 'glass cockpit' with three monochrome MFDs.

A J-10S prepares to start up its engine.

J-10S '50756 Yellow' caught by the camera on the point of lift-ing off. Note how much higher the back-seater sits.

could equip the carrier wing of the former Russian aircraft carrier *Varyag* which was sold to China and is being rebuilt for the PLA Navy.

Shenyang J-11 fighter (second use of designation)

The PLAAF was the first true export customer for the Sukhoi Su-27, operating the single-seat Su-27SK *Flanker-B* and the two-seat Su-27UBK *Flanker-C* since June 1992. After taking delivery of 48 Russian-built examples, China decided it wanted to build the Su-27. On 6th December 1996 the Russian military sales organisation Rosvo'oruzheniye (now Rosoboronexport) signed a licensing agreement worth an estimated US$ 2.7 billion with the Shenyang Aircraft Co., allowing the latter to manufacture 200 Su-27SKs – subject to the proviso that they would not be exported. Initially the fighters would be assembled from CKD kits supplied by the Komsomol'sk-on-Amur Aircraft Production Association (KnAAPO); the licence did not cover the engines and avionics, which were imported from Russia. By June 1997 SAC had received a full set of manufacturing documents for the *Flanker*.

In keeping with Chinese practice the licence-built Su-27SK was designated J-11, inheriting the designation of a stillborn fighter project described earlier (and, ironically, developed at Shenyang). Some sources, however, apply this designation retroactively to the Russian-built examples as well; moreover, the same sources refer to the PLAAF's Su-27UBKs as 'JJ-11s', although the two-seater was not covered by the licensing agreement!

In 1998 KnAAPO delivered the first two kits; both aircraft rolled off the SAC assembly line and were test flown in December. However, the local workmanship turned out to be substandard, and Russian technicians had to rebuild both aircraft. To remedy the situation, further imports of Russian-built *Flanker-B/Cs* followed in 2000-02.

Five aircraft had been assembled by 2000; by 2003 this number had risen to 20. By late 2004 all 105 parts kits (of diminishing completeness) representing the first batch had been delivered from Russia, of which 60 had been assembled and delivered to the PLAAF, but there was no sign of the follow-up order for 95. The Chinese-built machines entered service with the 1st Division based at Anshan AB and the 2nd Division at Suixi AB.

J-11B multi-role fighter

In late 2002 Shenyang reportedly began developing its own multi-role version of the J-11 incorporating up to 90% of locally made components, as the Chinese considered the Su-27SK 'old technology'. The changes included an indigenous multi-mode radar which had been tested on the Shaanxi Y8CB avionics testbed (see Chapter 6). The radar and other avionics allowed integration of the domestic PL-12 (SD-10) active radar-homing AAM and Chinese or Russian precision-guided munitions. The second major change was a switch to the Liming WS-10A turbofan which had been tested in a Su-27SK (or J-11) in 2002.

J-11 final assembly at the Shenyang aircraft factory.

2nd Division/6th Regiment J-11s on the flight line at Suixi AB and in flight.

'30107 Yellow' (c/n 0224), a J-11 fitted with Sorbtsiya wingtip ECM pods.

Wearing no markings other than the AVIC logo, a J-11B prototype begins a test flight. Note the dual missile rails under the engine nacelles.

At least three J-11B prototypes serialled 523, 524 and 525 were tested by the CFTE. Finally, in February 2008 the PLAAF's 1st Air Division took delivery of the first two production examples ('10121 Black' and '10123 Black').

J-11BS multi-role fighter

A two-seat version equivalent to the Su-27UBK but incorporating the same changes as the J-11B was developed and designated J-11BS (*Shuangzuo* – two-seater). The prototype was in final assembly at the Shenyang Aircraft Co. by May 2008.

Chengdu FC-1 Xiaolong (JF-17 Thunder) fighter

After the western powers pulled out of the Super 7 project in early 1990 in the wake of the Tiananmen Square massacre and the project was cancelled, China decided to carry on with the light fighter programme alone. In 1991 the Chengdu Aircraft Co. launched a new project designated FC-1 (Fighter China-1) and bearing the name Xiaolong (Fierce Dragon) – primarily for the export market. The Russian 'fighter maker' RSK MiG was actively involved in the design process. Pakistan, the launch customer, was also a risk-sharing partner, accepting 50% of the development costs which amounted to some US$ 150 million; the Pakistani designation was JF-17 Thunder (JF stood for Joint Fighter).

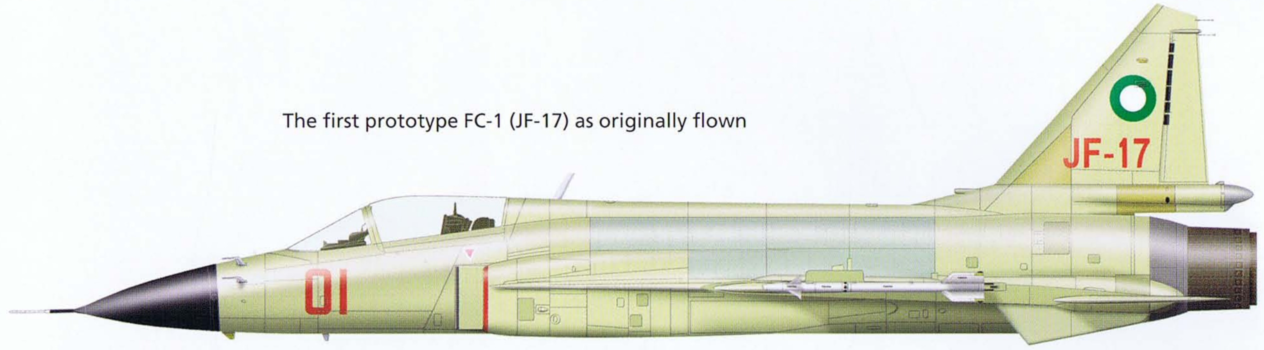
The aircraft had virtually nothing in common with the Super-7 whose origins lay in the J-7 family. The FC-1 had a blended wing/body design with mid-set trapezoidal wings swept back 42° at quarter-chord, with small scimitar-shaped LERXes and leading-edge manoeuvring flaps. The tail surfaces were also trapezoidal, with raked tips and no trailing-edge sweep; the stabilators were mounted on blended horizontal booms which also carried small ventral fins on the outer edges. The fuselage nose incorporated an ogival radome; the cockpit had a one-piece windscreen and an aft-hinged canopy. The nose gear unit retracted aft and the main ones forward.

The FC-1 was built around a Klimov RD-93 afterburning turbofan (a derivative of the MiG-29's RD-33 engine) rated at 5,040 kgp (11,100 lbst) dry and 8,300 kgp (18,300 lbst) in full afterburner. The engine breathed through two semi-circular air intakes with boundary layer splitter plates.

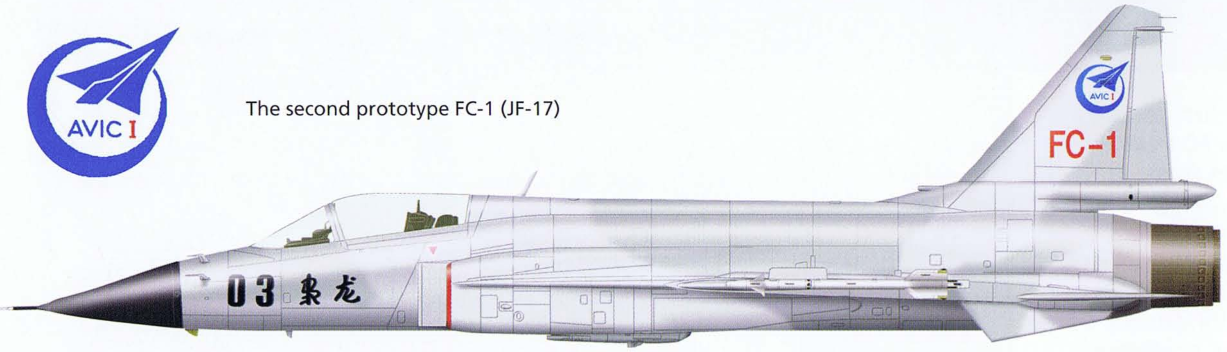
The aircraft had conventional mechanical powered flight controls, although FBW controls were considered for future versions. In keeping with current trends the FC-1 had a 'glass cockpit' with a wide-angle HUD and two MFDs, plus HOTAS controls. The FC-1's avionics architecture was supported by two mission computers linked by a MIL-STD-1553B databus.

The choice of radar depended on the customer; thus, Israeli Elta EL/M-2032, the British GEC-Marconi Blue Diamond, the French Thomson-CSF RDY or Thales RC400, the Russian Phazotron-NIIR Kop'yo (Spear) or the Italian Galileo (ex-FIAR) Grifo S7 could be fitted to export aircraft, while the domestic version (if the FC-1 was ordered by the PLAAF) would have the KLJ-10 radar.

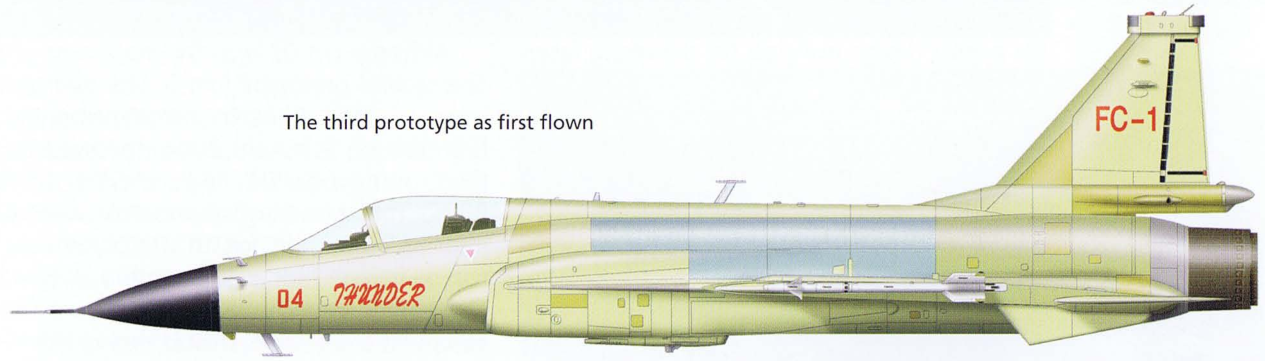
Seven external stores points were provided, including wingtip missile launch rails; the centreline pylon and the innermost wing pylons were 'wet', permitting carriage of drop tanks.



The first prototype FC-1 (JF-17) as originally flown



The second prototype FC-1 (JF-17)



The third prototype as first flown

07-101, the first JF-17 delivered to the Pakistan Air Force in March 2007

07-102, the PAF's second JF-17 (also delivered in March 2007)

The first proto-type FC-1 (JF-17) takes shape at the Chengdu factory.

The Pakistan Air Force planned eventual installation of an IFR probe. Possible air-to-air weapons included the PL-9, AIM-9P, Matra Magic 2 short-range AAMs and PL-11, PL-12 (SD-10) and R-27ER1 medium-range AAMs. A 23-mm Type 23-2 twin-barrel cannon was fitted on the port side of the lower centre fuselage. Various guided and unguided air-to-surface weapons could be carried, with provisions for a laser designator pod for delivering laser-guided weapons.

The first proto-type FC-1 was first flown in primer finish as '01 Red'.

The FC-1 was to commence flight tests in 1998, but the programme schedule repeatedly slipped due to technical and funding problems. Among other things, the Pakistan Air Force (PAF) revised its technical requirement, demanding higher performance, while western countries were reluctant to supply advanced avionics.

The first prototype FC-1 ('01 Red', c/n 01) was rolled out at Chengdu on 31st May 2003. On 1st July the aircraft began high-speed taxi runs. The 15-minute maiden flight took place on 25th August; on 3rd September the FC-1 made its official debut. '01 Red' (later '01 Black') was earmarked for flight performance testing and lacked the mission avionics.

Airframe c/n 02 was the static test article. The second prototype (c/n 03) featuring some minor modifications in aerodynamic design first flew on 9th April 2004, followed by the third prototype ('04 Red', c/n 04) in April 2006. This was the first example with a full avionics suite. The fourth prototype (c/n 05) was to be used for evaluating the SY-80 radar developed by the Aviation Radar and Electrical Equipment Institute (AREEI; ex-LETRI) as a competitor to the KLJ-10.

Upper view of the FC-1, showing the wing and tailplane planform and LERXes.

Now painted in demonstrator colours as '01 Black', the first prototype FC-1 undergoes maintenance.

The second prototype FC-1 in air superiority camouflage as '03 Black'.

Pakistan has been pressuring China into accepting the FC-1 for PLAAF service in order to increase the production run and reduce the unit costs; this was supported by the China National Aero-Technology Import and Export Corporation (CATIC). The Chinese military are opposed to that, believing that equipping the Air Force with two types of fighter planes with similar performance within the same time period would both consume limited financial resources and complicate logistical support for dissimilar aircraft.

CAC and the Pakistan Aeronautical Complex were to begin joint production of an initial 16 aircraft in 2006 but production was delayed. Then, in January 2007 Russia threw a spanner in the works, disallowing the transfer of RD-93 engines to third countries – a move that suited India which was at odds with Pakistan. Yet, in April 2007 Russian President Vladimir Putin reversed this decision.

The first two production JF-17s were delivered to the PAF in March 2007, six more

'04 Red', the still-unpainted third prototype FC-1, takes off. Note the aerial under the nose.

The cockpit of the JF-17 features three colour MFDs and a wide-angle HUD.

following in March 2008; these aircraft are now used for operational evaluation. Pakistani production of JF-17 components started in January 2008. The PAF selected the Grifo S-7 radar for its JF-17s but agreed to accept the KLJ-10 radar in the first batch of aircraft. Pakistan plans to acquire up to 150 aircraft. Nations that have reportedly evinced an interest in the FC-1 are Azerbaijan, Zimbabwe, Bangladesh, Myanmar, Egypt, Iran, Lebanon, Malaysia, Morocco, Nigeria, Sri Lanka, Algeria and Sudan.

The aircraft is 14.7 m (48 ft 2¾ in) long and 4.8 m (15 ft 9 in) high, with a wing span of 9.5 m (31 ft 2 in); the wing area is 24.4 m^2 (262.6 sq ft). The fighter has an empty weight of 6,450 kg (14,220 lb), an internal fuel load of 2,300 kg (5,071 lb) and an ordnance load of 3,600 kg (7,9371b); the normal and maximum take-off weight is 9,100 kg (20,060 1b) and 12,400 kg (27,337 lb) respectively. The maximum wing loading is 520.5 kg/m^2 (106.61 lb/sq ft), while the maximum power loading is 1.53 kg/kgp (lb/lbst). The aircraft has a maximum speed of Mach 1.8, a service ceiling of 16,000 m (52,495 ft), a maximum range on internal fuel of 1,800 km (1,118 miles) and a combat radius of 1,200 km (745 miles) in counter-air configuration and 700 km (435 miles) in strike configuration. The take-off and landing run are 450 m (1,480 ft) and 750m (2,460ft). The airframe is stressed for 8Gs.

07-101, the first JF-17 delivered to the Pakistan Air Force, shows off its undersides.

XXJ (J-XX) future fighter projects

Speculations have abounded in the aviation community recently of Chinese fifth-generation fighter programmes; the Chengdu Aircraft Co. and the Shenyang Aircraft Co. are known to be working on such projects. Generally the fighter is referred to as J-XX or XXJ, but designations like J-12, J-13 and J-14 have been guessed at. Images circulated on the Internet show twin-engined stealthy aircraft bearing a striking resemblance to the Lockheed Martin F-22A Raptor but featuring canards in addition to (or instead of) the usual tailplanes, and sometimes having a single chin air intake. Yet this is all guesswork (or even deliberate disinformation), and it will certainly be a long time before the actual aircraft is revealed.

Another view of 07-101, showing the special colour scheme in Chinese and Pakistani colours.

3 The Bombers

Bomber development in China was largely based on Soviet aircraft that took their own line of development on the other side of the Great Wall – although at least one indigenous bomber design (and an amphibian at that!) is known. Special mission and trainer derivatives of the bombers are included.

Tupolev Tu-4 – Chinese conversions

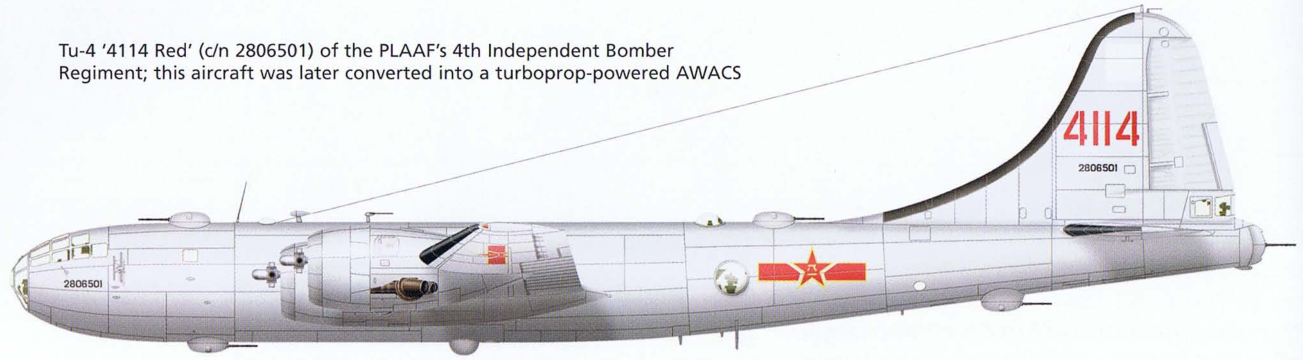
Tu-4 turboprop conversion

In the 1950s, as the Soviet Air Force's long-range bomber arm started re-equipping with jet aircraft, a number of obsolescent Tupolev Tu-4 bombers (NATO reporting name *Bull*) – Soviet copies of the Boeing B-29A Stratofortress – were transferred to China free of charge. These aircraft provided the PLAAF with a valuable strategic asset in the event of a military conflict with Taiwan.

In the 1970s, as the bombers' 2,400-hp Shvetsov ASh-73TK radial engines ran out of service life and new ones proved impossible to obtain, the PLAAF decided to give the few remaining Tu-4s a new lease of life by re-engining them. Thus, several aircraft were fitted with 4,250-ehp Zhuzhou WJ-6 turboprops (*Wojiang* – turboprop engine, Type 6) driving Baoding J17-G13 four-bladed reversible-pitch propellers – Chinese copies of the Ivchenko AI-20K engine and the AV-68 propeller. The turboprops had a markedly smaller diameter than the original radials; hence tapered fairings were made to close the gap, resulting in weird-looking nacelles with a pronounced bottle shape. The jetpipes were located on the outer faces of the nacelles beneath the wing leading edge. To compensate for the stronger yaw in the event of a single-engine failure, small pentagonal endplate fins were mounted at the tips of the horizontal tail for added directional stability.

'4134 Red' (c/n 225008), a Tu-4 bomber refitted with WJ-6 turboprops and converted into a carrier for WZ-5 reconnaissance drones. The aircraft is on view at the PLAAF Museum.

Another view of '4134 Red', showing the lattice-like racks from which the drones are suspended.



Tu-4 '4114 Red' (c/n 2806501) of the PLAAF's 4th Independent Bomber Regiment; this aircraft was later converted into a turboprop-powered AWACS

The re-engined bombers remained in service with the PLAAF until the 1980s. At least two of them were further converted into special mission aircraft described below.

Tu-4 drone launcher

One of the Tu-4 turboprop conversions, an example built by plant No. 22 in Kazan' and serialled '4134 Red' (c/n 225008), was converted into a drone launcher aircraft. Two racks mounted on truss-type structures were fitted under the outer wing panels for carrying Chang Hong-1 (aka WZ-5) photo reconnaissance drones. The Chang Hong-1 was a reverse-engineered version of the Ryan AQM-34N Firebee, a number of which had fallen into Chinese hands in the 1960s.

Tu-4 '4134 Red' is now preserved at the PLAAF Museum at Xiaotangshan AB.

Tu-4 AWACS testbed

Another 'Turbo Bull', this time a Tu-4 built by plant No. 18 in Kuibyshev ('4114 Red', c/n 2806501), was converted into an aerodynamics testbed for a prospective airborne warning and control system (AWACS) aircraft. A conventional rotodome with two dielectric segments was mounted above the wing centre section on two N-struts with bracing wires in between; however, no radar was ever installed in it. Additionally, a fairly large dielectric canoe fairing was added aft of the nosewheel well, with a smaller canoe fairing and two thimble fairings aft of the wings. A small ventral fin was added to improve directional stability.

The AWACS testbed is likewise on display at the PLAAF Museum.

Harbin H-5 (B-5) tactical bomber

In the early 1950s the PLAAF started taking delivery of the Il'yushin IL-28 tactical bomber (NATO reporting name *Beagle*). The aircraft, which first flew in July 1948, featured a rather curious combination of shoulder-mounted unswept wings and swept conventional tail surfaces; it was powered by two 2,700-kgp (5,950-lbst) Klimov VK-1 centrifugal-flow turbojets in area-ruled nacelles which adhered directly to the wing undersurface and accommodated the main gear units as well. The bomber had a crew of three – a pilot seated in a fighter-type cockpit, a navigator/bomb-aimer in the extensively glazed nose and a gunner operating the hydraulically powered twin-cannon tail barbette.

'4114 Red', another Tu-4 (c/n 2806501) converted into a turboprop-powered AWACS testbed. It is also on display at Xiaotangshan.

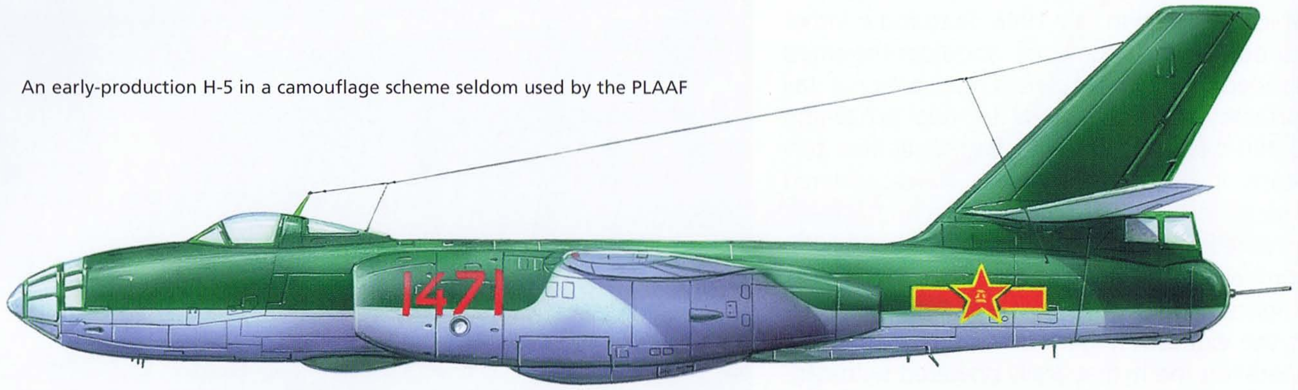
The IL-28 became the PLAAF's first modern bomber and a valuable asset, seeing action during the First Taiwan Crisis of 1954-55. A repair facility for the type was set up in Harbin but no manufacturing licence for the type was obtained. Hence after the rift in Sino-Soviet relations China decided to build the Il-28 – without the benefit of a licence.

Production of the IL-28, which received the local designation H-5 (*Hongzhaji* – bomber), was logically assigned to the Harbin aircraft factory. Due to the exigencies of the 'Cultural Revolution' the preparations did not begin until 1963. To be perfectly honest, the Chinese did not adopt a simple copycat approach and altered the design considerably, changing 40% of the structure and systems. In particular, the wing panels and tail surfaces of the original Soviet bomber had a manufacturing break along the chord line. Each half of the subassembly consisted of several skin panels incorporating stringers and ribs; this allowed different panels to be manufactured simultaneously at different workstations while improving working conditions. In contrast, the Chinese dispensed with this manufacturing break and used a conventional wing design on the H-5; this saved some 110 kg (242 lb) of weight, albeit the manufacturing process became more difficult.

Changes were made to the armament – the original IL-K6 spherical tail turret with two Nudelman/Richter NR-23 cannons was

The H-5 final assembly shop at the Harbin Aircraft Factory.

The flight line of a PLAAF bomber unit operating H-5s. Note the original positioning of the serials on the tails.



An early-production H-5 in a camouflage scheme seldom used by the PLAAF

replaced by a DK-7 turret of basically cylindrical shape mounting two Afanas'yev/Makarov AM-23 cannons; the new installation brought about some changes to the fuselage structure. The new turret was borrowed from the Tupolev Tu-16 medium bomber (built in China as the H-6, which see) for the sake of commonality. The AM-23 had the same 23-mm calibre but a much higher rate of fire (1,300 versus 850 rounds per minute) and the ammunition supply was more than doubled – from 225 to 500 rpg. Additionally, the Chinese version had a different bomb-aiming radar with greater operational range, a different bomb sight with a wider field of view, and a different identification friend-or-foe system.

The different tail turret was the main external identification feature of the H-5. Also, the cockpit canopy had a one-piece blown transparency (without a lengthwise frame member), a taxi light was added to the forward door of the nosewheel well and the starboard forward-firing cannon was deleted.

Manufacturing of jigs and tooling started in 1964. The first two airframes – the flying prototype and a static test airframe – were completed in 1966 and the H-5 prototype took to the air on 25th September 1966, flown by pilot Wang Wenying, navigator Zhang Huichang and radio operator Zeng Fannan. Full-scale production at Harbin commenced in April 1967. The VK-1 engines for the bomber were manufactured by the Shenyang Engine Factory (SEF) as the WP-5A.

HJ-5 bomber trainers operated by one of the PLAAF's flying academies.

Flight simulation, PLAAF style? These airmen are pacing the flight line with dummy H-5 windscreens in their hands! The nearest two aircraft are HJ-5s lacking tail turrets, the others are H-5 bombers.

Chinese-built *Beagles* were exported to Albania and Romania; the export version was designated B-5 (for bomber). The last of the Romanian examples remained active past 2000.

H-5A (?) nuclear-capable version

A tactical nuclear strike version similar to the Soviet IL-28A was developed in September 1967 for both test and operational applications. No confirmed designation is known, although some sources attribute the designation H-5A to this version.

The development effort was led by Xia Zhenhua; the first test drop of a nuclear bomb from such an aircraft took place on 27th December 1968.

H-5 torpedo-bomber

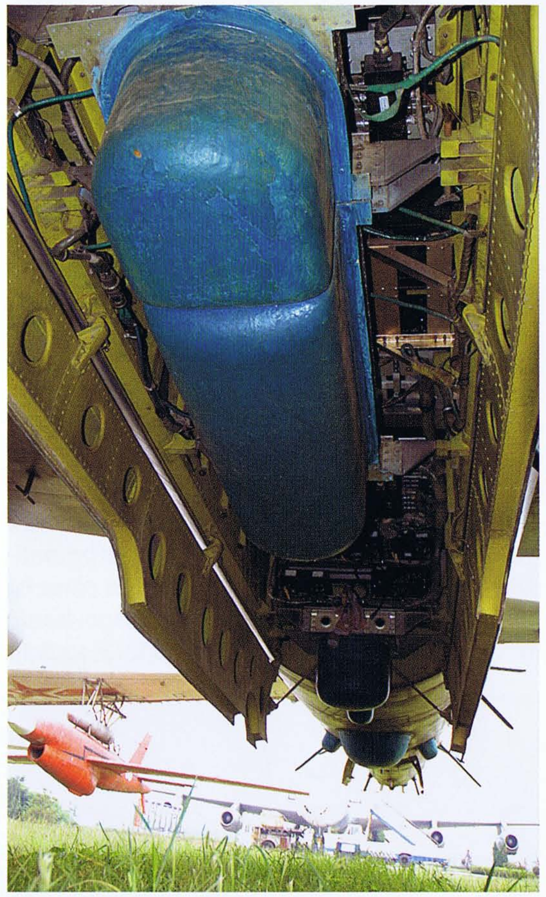
A torpedo-bomber version equivalent to the Soviet Navy's IL-28T was developed for the PLANAF. It was armed with two Yu-2 torpedoes for attacking surface ships. Again, no separate designation is known.

HJ-5 (BT-5) bomber trainer

The IL-28 had a conversion trainer variant called IL-28U (NATO reporting name *Mascot*), which differed from the basic bomber primarily in having a new nose grafted on in place of the navigator's station (up to fuselage frame No. 6). It incorporated an instructor's cockpit with a stepped windscreen, rather like the flight deck of an airliner *en miniature*; the trainee pilot sat in the standard cockpit. All armament and bomb aiming equipment, including the radar, were deleted; to maintain the CG position the tail turret was substituted by ballast. Still, the IL-28U could be used for training gunners/radio operators, for which the former gunner's station was suitably equipped.

H-5s operated by the PLANAF Academy in Xingdao, including '13002 Red' and '83002 Red', had underwing external stores pylons.

PLAAF H-5s unload their bombs over a target range in China.



'21112 Red', an HD-5 ECM aircraft, at the PLAAF Museum.

'83130 Red', the H-5 Ying radar/ weapons testbed with a nose radome and YJ-8 ASMs under the wings.

This view shows the HD-5's emitter antennas, some of which are housed in the bomb bay with modified doors.

'30514 Red', an operational HD-5, takes off.

Unsurprisingly, a Chinese analogue of the *Mascot* designated HJ-5 (*Hongzhaji Jiaolianji* – bomber trainer) was also produced in Harbin. The prototype made its first flight on 12th December 1970; the HJ-5 was officially phased in by the PLAAF in 1972 and a total of 187 was built. Several examples were exported as the BT-5 (bomber trainer).

HZ-5 (B-5R) tactical reconnaissance aircraft

The Chinese also developed a photo reconnaissance version of the H-5 equivalent to the IL-28R ([samolyot-] razvedchik) reconnaissance aircraft). Brought out in 1970, it bore the designation HZ-5 (*Hongzhaji Zhenchaji* – bomber/reconnaissance aircraft) for the 'home market' or B-5R for export. The aircraft was equipped with two cameras for day/night high-altitude photography. Unlike the Soviet recce version, the HZ-5 had underwing drop tanks instead of tip tanks; these extended range by 47%, the combat radius by 50% and endurance by 1 hour 23 minutes. Development of the PHOTINT version was rather protracted and the aircraft was not officially included into the PLAAF inventory until 1977.

A PLANAF H-5 used as a target tug, with towed targets and their slipstream-driven winches under the wings.

HD-5 ECM aircraft

In the 1980s a small number of H-5s were converted to an electronic countermeasures (ECM) version designated HD-5 (*Hongzhaji Dian* – bomber/electronic warfare aircraft). The bomb bay housed a powerful jammer suite; the fuselage sides ahead and aft of the wings bristled with blade aerials, and more antennas were housed in dielectric fairings on the fuselage underside. The armament was deleted, the tail turret being replaced by another dielectric fairing, and the crew included an electronic warfare officer instead of a gunner.

The H-5 was exported to several countries as the B-5. Albania was one of the customers; here, '3-608' sits in a hangar at Tirana-Rinas in 2005.

Romania was another operator of the H-5. '308 Red' is depicted at Fetesti-Borcea AB in 2004.

Specifications of the H-5

	H-5	HJ-5
Length overall	16.768 m (55 ft 0 5/32 in)	17.472 m (57 ft 3 7/8 in)
Height on ground	6.20 m (20 ft 4 3/32 in)	6.20 m (20 ft 4 3/32 in)
Wing span	21.45 m (70 ft 4 31/64 in)	21.45 m (70 ft 4 31/64 in)
Wing area, m^2 (sq ft)	60.8 (653.76)	60.8 (653.76)
Normal all-up weight, kg (lb)	18,400 (40,570)	n.a.
Maximum all-up weight, kg (lb)	21,200 (46,740)	18,260 (40,260)
Bomb load, kg (lb):		
normal	1,000 (2,204)	–
maximum	3,000 (6,613)	
Top speed, km/h (mph)	902 (560)	902 (560)
Service ceiling, m (ft)	12,500 (41,010)	n.a.
Ferry range at 10,000 m (32,810 ft), km (miles)	2,400 (1,490)	2,394 (1,486)

The HD-5 usually operated in flights of three to cover a wide range of frequencies. The type remained in service at least until 1997; later it was replaced by an ECM version of the Shaanxi Y8 transport.

H-5 Ying avionics/weapons testbed

As part of the Xian JH-7 fighter-bomber's development programme, the Research Institute No. 603 converted a PLANAF H-5 serialled '83130 Red' into a combined avionics/weapons testbed known as H-5 *Ying* (Eagle). The navigator's station of this aircraft was eliminated, the nose glazing being supplanted by a large ogival radome tipped with a pitot; the radome housed a Type 232H Eagle Eye fire control radar. Two pylons were installed under the outer wings, enabling the carriage of two YJ-8 anti-shipping missiles. The actual conversion work was done by the Navy's repair plant No. 4724.

HJ-5 ejection seat testbed

One HJ-5 trainer is known to have been modified for ejection seat trials. In the Soviet Union, one IL-28 had seen use in the same capacity but the aircraft in question had been a regular bomber, not a trainer.

H-5B (?) engine testbed

As early as the end of 1962 the issue arose of replacing the IL-28's VK-1 turbojets with more powerful and fuel-efficient engines. The Shenyang Aero-Engine Research Institute (SARI) and the Chinese Aeronautical Establishment (CAE) started developing the WS-5 turbofan. Based on the core of the proven WP-6 (Mikulin RD-9B) turbojet, it utilised the rarely used aft-fan layout and had adjustable stator vanes on the first three compressor stages instead of bleed valves as a means of preventing surge.

The design work was apparently completed as early as 1963 and the first prototype ran in 1965. The bench tests were beset by troubles – the aft fan was not performing as it should and the turbine blades failed after a very short running time. The WS-5 had to be redesigned repeatedly, and it was only the seventh prototype engine that showed the desired results during bench tests.

It was planned to use a suitably modified H-5 bomber as a testbed for the WS-5, and the engine nacelles were redesigned to accept the turbofans. With a thrust of 3,570 kgp (7,870 lbst), the new engine was expected to give a dramatic boost in performance. A prototype was actually built and reportedly even began taxying tests, but in 1973 the government cancelled the programme without giving any reasons. Some sources attribute the designation H-5B to the re-engined aircraft.

Xian H-6 medium bomber

In early 1956 the Soviet Union agreed to licence production of the Tupolev Tu-16 medium bomber (NATO reporting name *Badger*) in China. The aircraft, which first flew in April 1952 and entered Soviet Air Force service in February1954, represented the then-latest state of the art in Soviet bomber design. The Tu-16 had mid-set wings with moderate sweepback and conventional swept tail sur-

'An unserialled HZ-6 reconnaissance aircraft; the ELINT pods are just visible below the wings.

faces; the four-wheel bogies of the main landing gear units retracted aft, somersaulting through 180° to lie in large fairings projecting beyond the wing trailing edge. The powerplant consisted of two Mikulin RD-3M-500 axial-flow turbojets with a take-off thrust of 9,520 kgp (20,990 lbst) placed on the fuselage sides immediately aft of the rear wing spar so that the inlet ducts passed through the wing roots, the fuselage being 'pinched' in accordance with the area rule. The crew consisted of two pilots, a navigator/bomb-aimer (sitting in an extensively glazed nose), a dorsal gunner/radio operator sitting behind the pilots, plus two more gunners sitting in a separate pressure cabin in the rear fuselage. The defensive armament comprised three powered barbettes with twin 23-mm AM-23 cannons and a single fixed cannon of the same type in the nose.

The actual licence agreement for manufacture of the Tu-16 was signed in September 1957. Under the terms of this, China received two production Tu-16 bombers as pattern aircraft, a further two aircraft in the form of a semi-knocked-down (SKD) kit and a CKD kit, essential for mastering the assembly of the first examples, and a set of blanks and raw materials for parts manufacture together with the necessary technical documentation. All of this was supplied by plant No. 22 in Kazan', the main manufacturer of the type.

In 1959 the decision was taken to begin licence production in China, and in the same year a large technical team left the USSR for China to assist in setting up series production. It remained in China until the autumn of 1960.

The Bureau of Aircraft Industry (BAI) allocated two factories in Harbin and Xian

These 250-kg bombs will shortly be loaded into PLAAF 36th Division H-6 bombers at Wugong. Note the low-visibility national insignia.

The flight line of the PLAAF 8th Division at Leiyang crammed with blue-coded H-6s. Oddly, the crews are running *away* from the aircraft, not towards them!

(sometimes spelled Xi'an) for Tu-16 production. A major reconstruction of the Harbin Aircraft Factory, in the course of which the shop floor area was doubled, began in 1958; the plant received assistance in the form of 200 qualified workers seconded from the Shenyang Aircraft Factory. In May 1959 the Harbin plant took delivery of the two Tu-16 pattern aircraft and the CKD kit, and assembly of a bomber from the kit began immediately. The first Chinese Tu-16 was assembled in just 67 days (28th June – 3rd September), making its maiden flight on 27th September 1959, and was handed over to the PLAAF that December.

In 1958 the large aircraft factory at Xian was completed, and to assist in Tu-16 production there 1,040 skilled technical and engineering staff and 1,697 other workers were transferred from Shenyang. In 1961 the BAI decided to concentrate all work on the Tu-16 at the Xian factory so that the Harbin plant could concentrate on the H-5; the transfer of production took place in 1962-64. The Chinese licence-built version was briefly designated Feilong-201 (Flying Dragon-201) but became the H-6 in 1964. The RD-3M-500 was built under licence at the Xian Engine Factory (with assistance from the Harbin and Shenyang plants) as the WP-8.

In 1964 the plant began manufacturing the jigs and tooling for series production of the H-6; new production methods differing from the Soviet ones were used, including explosive forming and epoxy resin male moulds instead of metal ones. In October 1966 the first airframe assembled from Chinese parts was finished, one year ahead of schedule; it underwent static tests at the BAI's Aircraft Structure Analysis Research Institute in December 1968.

On 24th December 1968 the first Xian-built production H-6 bomber completely manufactured in China (with Chinese-made WP-8

This H-6 preserved at the PLAAF Museum has a bogus four-digit serial (it is actually '10794 Blue') and normal red national insignia.

A brand-new B-6D missile strike aircraft (the export version of the H-6D) on the factory apron at Xian. Note the missile pylons.

engines) made its first flight. The crew was commanded by test pilot Li Yuanyi, with Xu Wenhong as co-pilot. After this, full-scale production of the H-6 in China got under way.

The reason that it took so long to establish H-6 in production in China was the disorganisation of the Chinese aircraft industry caused by the spread of the 'Cultural Revolution'. A lot of design documentation was lost during the transfer of production from Harbin to Xian, and it took forever to restore it.

The London Institute for Strategic Studies estimates that approximately 120 H-6 bombers in various versions had been built up to 1987 when production was interrupted. It was resumed several years later.

The standard H-6 was 34.8 m (114 ft 2⁵⁄₆₄ in) long and 9.85 m (32 ft 3⁵¹⁄₆₄ in) high, with a

H-6s share the final assembly shop at Xian with Y7H transports. An H-6D is in the foreground, with a 'solid-nosed' HY-6 tanker on the left.

Another view of the same shop, with three H-6Ds (note the deep chin radome and pylons) seen over the tail of a Y7-100 airliner demonstrator.

wing span of 34.2 m (112 ft 2²⁹⁄₆₄ in). The normal and maximum take-off weight were 72,000 kg (158,730 lb) and 75,800 kg (167,110 lb) respectively; the bomber could carry a normal weapons load of 3,000 kg (6,610 lb) and a maximum weapons load of 9,000 kg (19,840 lb). The maximum fuel load was 33,000 kg (72,750 lb). The H-6 attained a maximum speed of 1,014 km/h (630 mph) at 6,250 m (20,500 ft), a cruising speed of 786 km/h (488 mph) or Mach 0.75 and a service ceiling of 13,100 m (42,980 ft). The ferry range was 6,000 km (3,728 miles) and the combat radius was 1,800 km (1,120 miles).

H-6A nuclear-capable bomber

Even before production of the H-6 had been fully implemented, the modification of a Tu-16 assembled from Soviet parts into a carrier for the Chinese atomic bomb started at Xian under the codename 'Mission 21-511'. The bomb bay was heat-insulated and air-conditioned to provide the correct environment for the nuclear weapons, the bomb release system was modified and the necessary monitoring and recording equipment for nuclear testing was installed. To all intents and purposes this aircraft was the counterpart of the Soviet Tu-16A. The modification work was supervised by Li Xipu.

The modified aircraft was the prototype of the nuclear-capable H-6A. On 14th May 1965 this aircraft captained by Li Yuanyi successfully carried out the third Chinese nuclear test, dropping a 20-kiloton atomic bomb over the Lop Nor nuclear test range in western China. The flight crew received a collective government award for this mission. On 29th September 1969, an H-6 bomber dropped China's first thermonuclear bomb with a yield of 3,000 kilotons.

H-6B (?) ELINT aircraft

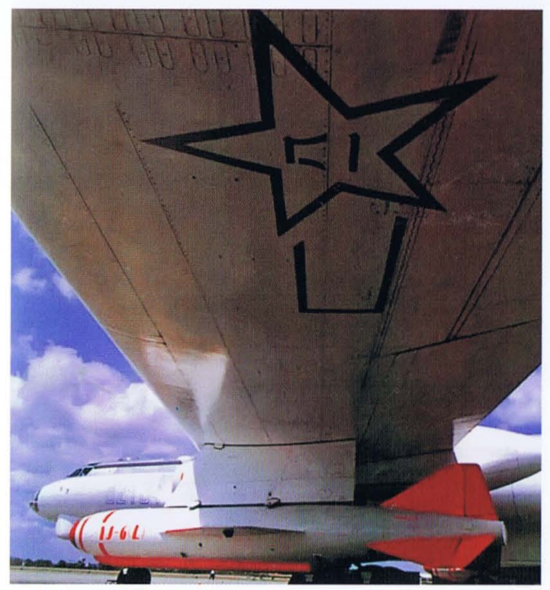
At least one H-6 was converted into an ELINT version with pylon-mounted underwing pods similar to the SRS-3 pods of the Soviet Tu-16R and a hemispherical dielectric blister ahead of the bomb bay. The designation H-6B quoted in some sources for a reconnaissance version may apply to this aircraft – unless the Chinese have developed more than one reconnaissance version.

H-6C (H-6 III) nuclear-capable bomber

In 1970 work began on a second-generation integrated navigation/bomb-aiming system for the H-6A featuring a high degree of automation. The system comprised an onboard computer, an automatic plotter, an attitude & heading reference system (AHRS), a Doppler navigation radar, a more refined autopilot and a new bomb-aiming radar.

Tests of an H-6A fitted with the new system and reportedly designated H-6C or H-6 III

An H-6D carrying two YJ-6(L) anti-shipping missiles during trials.



Instrumented test versions of the YJ-6(Y) and YJ-6(L) anti-ship missiles under the wings of the same H-6D.

Armourers prepare to hook up a KD-63 land attack cruise missile to H-6H '40176 Red'.

The flight line of the 36th Division at Wugong, with a mix of white- and grey-painted H-6E bombers. '50777 Blue' has part of the flight deck roof over the co-pilot's seat removed.

A rather unusual perspective of H-6E '50679 Blue' at Nanyuan AB in September 1999.

were held between 1975 and 1981. The system, in many of its essentials, was based on Western components and whatever other parts were available. The updated avionics suite was introduced on the H-6A production line in 1982. The aircraft could carry conventional and nuclear bombs, lay anti-shipping mines and drop torpedoes. Most Chinese bombers were produced in this version, serving with the PLAAF and the PLANAF.

'40079 Red', an H-6H of the 36th Division serialled under the 2005 system, shows off the ventral dielectric blister associated with LACM guidance that distinguishes it from the earlier H-6D.

H-6D (H-6 IV, B-6D) missile strike aircraft

In 1975 work began on an anti-shipping missile strike version of the H-6A for the PLANAF. The carrier, given the designation H-6D (originally H-6 IV), featured a missile guidance system, an automated navigation system and a new Type 245 surveillance radar in a much-enlarged flat-bottomed chin radome linked to the missile guidance system. At an altitude of

An H-6H passes overhead. toting a pair of KD-63 cruise missiles. The area ruling of the fuselage is evident in this view.

'43595 Blue', an HY-6 refuelling tanker, shows off the port RDC-1 hose drum unit.

9,000 m (29,530 ft) the radar could detect a surface target with a radar cross-section of 7,500 m² (80,645 sq ft) from a maximum range of 150 km (93 miles). The wings were strengthened for carrying two YJ-6L anti-shipping cruise missiles which were suspended on pylons resembling those of the Soviet Navy's Tu-16KSR-2 missile strike aircraft.

Crews race towards their HY-6s during a practice alert. The new-build tanker's peculiar nose is clearly visible here.

The YJ-6L air-to-surface missile (export designation C-601, NATO codename CAS-1 *Kraken*) was developed in China from the HY-2 ship-/land-based anti-shipping missile – a copy of the Soviet P-15 supplied to China at the end of the 1950s. The missile was powered by a liquid-fuel rocket motor and fitted with a 513-kg (1,131-lb) high-explosive warhead; it had a range of 120 km (74.5 miles)

The RDC-1 podded HDU as fitted to the HY-6 and H-6DU tankers.

and a speed of Mach 0.8. The H-6D reportedly also retained a level bombing capability.

The first flight of the experimental H-6D took place on 29th August 1981 with Zhai Xijie in the captain's seat. The first launch of a YJ-6L instrumented test round followed on 6th December; all four tests of inert missiles were reportedly successful. The test program for the aircraft and the ASM complex as a whole was concluded by live missile tests at the end of 1983. In December 1985 the new anti-shipping complex entered service with the People's Liberation Army Naval Air Force (PLANAF).

In May 1985 the H-6D with its C-601 missiles was exhibited at the Paris Air Show.

Later, the YJ-6L was replaced by the more modern YJ-61 (C-611) missile which has a range of 200 km (124 miles). The export version of the H-6D was designated B-6D (B for bomber); four were supplied to Iraq.

The dimensions of the H-6D were identical to those of the standard bomber, and the performance was similar. Differences included a service ceiling reduced to 12,000 m (39,370 ft).

H-6E nuclear bomber

The H-6E is a modernised version of the H-6A – a dedicated nuclear bomber with upgraded onboard equipment, upgraded engines and a new ECM system. Externally it differs from the H-6A in lacking the latter's nose gun position and in its grey/sky-blue finish which makes it less visible from below. Some sources have called it H-6 I but see below.

The H-6E entered service in the late 1980s. However, despite its updated avionics, the aircraft had no stand-off attack capability and therefore was vulnerable to enemy air defences. This led to the development of the H-6G missile strike version.

H-6F bomber

In the early 1990s some H-6A and H-6C bombers received a mid-life update concerning mostly their mission avionics and were redesignated H-6F. The most significant improvement was the introduction of an integrated navigation suite comprising an inertial

Head-on view of an H-6DU tanker based on the H-6D and retaining the latter's glazed nose and deep chin radome.

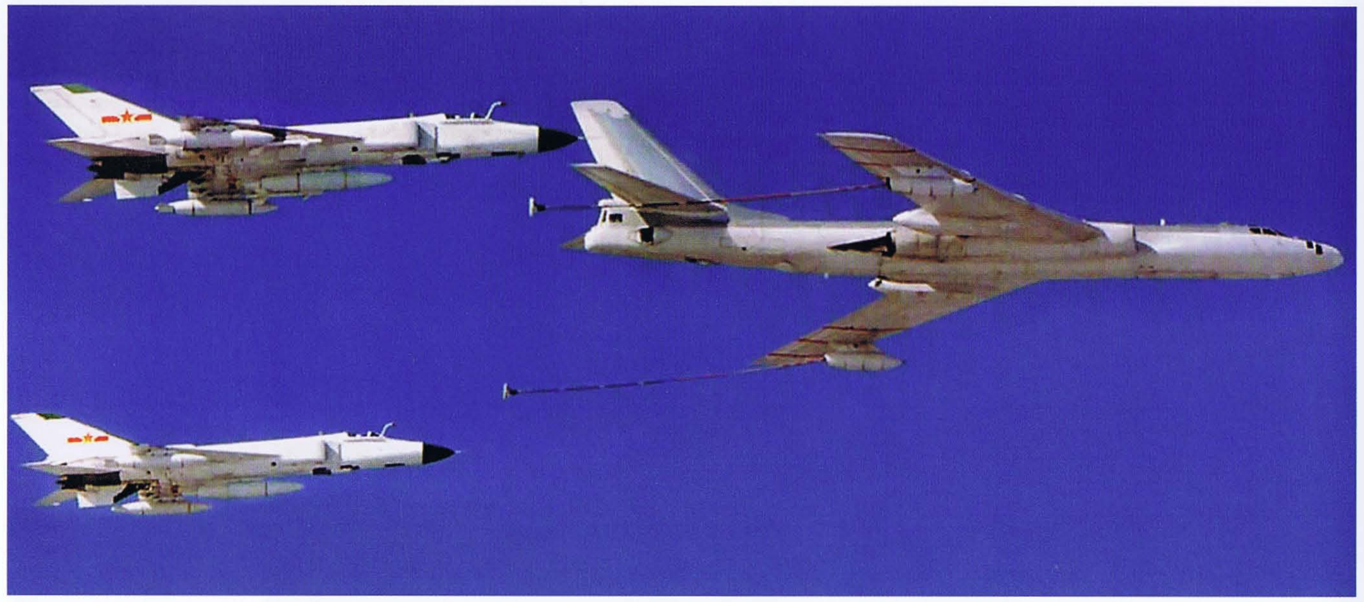
navigation system, satellite navigation (GPS) and a Doppler navigation radar. The original manually operated bombing sight was replaced by an automatic fire control system, enabling the bomber to perform long-range interdiction and maritime strike missions at low altitude in all-weather, day/night conditions. The forward-firing cannon in the nose was deleted. Like the H-6E, the bomber wore a light grey low-visibility colour scheme.

The H-6F was incapable of delivering precision guided munitions (PGMs). Therefore it was intended to be used mainly as a maritime bomber for conventional level bombing against surface ships if the enemy air defences were relatively weak. Yet modern naval ships are equipped with highly effective anti-aircraft missile systems making the bomber highly vulnerable.

HY-6 (H-6U, HU-6) refuelling tanker

Until the late 1980s, the primary role of the PLAAF was to defend the mainland; hence there was no requirement for in-flight

A fine shot of HY-6 '69696 Blue' wearing a low-visibility grey colour scheme.



A pair of J-8D interceptors formates with an HY-6 trailing both drogues. The serials have been removed by the military censor.

refuelling. Later, however, the PLA began a modernisation programme to transform itself from a purely defensive force to a force with both offensive and defensive capabilities. This sparked a requirement to expand the Air Force's and Naval Aviation's reach to China's peripheral regions, such as the South China Sea and Taiwan Strait – and hence for IFR capability. Such a need first arose when the Chinese and Vietnamese navies clashed in the South China Sea in 1988.

The H-6 bomber was selected as the basis for the PLAAF's first tanker designated HY-6 (*Hongzhaji You* – bomber/tanker); it has also been referred to in the press as the H-6U or HU-6. Like most air forces, the PLAAF chose the probe-and-drogue IFR system; however, unlike the Soviet tanker variants of the *Badger* (the Tu-16Z and Tu-16N), the HY-6 was intended for supporting tactical aircraft (notably the Shenyang J-8D interceptor) and was therefore a two-point tanker with RDC-1 podded hose drum units (HDUs) mounted on pylons under the outer wings.

The provenance of the HDUs merits a comment. China initially approached several western manufacturers for potential purchase or licence production of IFR systems. However, these plans were foiled by the sanctions imposed in the wake of the 1989 Tiananmen Square massacre. In the early 1990s, China reportedly obtained some 1960s/70s-era western-made IFR equipment via Israel or Iran; this was later used by China's Institute of Aero Accessories as a pattern for developing the RDC-1 HDU.

The fuel load was 37,000 kg (81,570 lb), and 18,500 kg (40,785 lb) of it was transferable fuel. The refuelling systems operator's station was located in the former tail gunner's station of the H-6 bomber.

Changes were made to the avionics. The most obvious one was a weather/navigation radar mounted conventionally in a redesigned

An HY-6 jettisons fuel from the port wing tank. Note the red stripes on the wing underside helping the pilot of the receiver aircraft to formate with the tanker.

A still-unpainted H-6M is prepared for a pre-delivery test. The four missile pylons are clearly visible.

nose ahead of the navigator's station, which had a greatly reduced glazing area; the usual chin radome was deleted. Also, the tanker had a duplicated (main and backup) inertial navigation system, plus a duplicated tactical area navigation (TACAN) system ensuring rendezvous with the receiver aircraft, with all-weather day/night mutual detection and approach from distances up to 200 km (124 miles). The HY-6 also had a radio/light signal system for night refuelling operations.

The HY-6 was unveiled in model form during a defence technology exhibition held in Beijing in 1988. The actual prototype was

'81214 Red', a PLANAF H-6M, takes off. This version also wears the grey low-vis scheme.

Sister ship '81216 Red' shows the H-6M's lack of the tail turret and gunner's station glazing (including the lateral blisters).

This model is the only evidence of the existence of the HD-6 ECM version with a ventral canoe fairing and a 'solid' nose.

probably completed in 1989, the maiden flight taking place in 1990. The first successful aerial refuelling operation between an HY-6 and a J-8D fighter aircraft took place in 1993. Proof of the actual aircraft's existence (in the form of US surveillance satellite imagery) did not come until 1996. During the National Day military parade held in Beijing on 1st October 1999, two HY-6 tankers escorted by four J-8Ds flew over Tiananmen Square, indicating that the aircraft was already in operational deployment.

It is currently estimated that 10 new-build examples of the HY-6 served with the PLAAF 8th Air Division at Laiyang AB in Guangzhou province. Each tanker is capable of refuelling two J-8D fighters simultaneously, and up to six fighters in one sortie, extending their combat radius from 800 to 1,200 km (from 496 to 745 miles). The HY-6 is also capable of refuelling the Chengdu J-10 fighter and possibly the Xian JH-7 fighter-bomber too, but is not compatible with the IFR probe of the Su-30MKK fighter. This prompted the PLAAF to order the Il'yushin IL-78MK tanker/transport (NATO reporting name Midas) from Russia, and these aircraft are to cater for the Su-30MKKs.

H-6DU Tanker

Some H-6D naval ASM carriers were converted into two-point hose-and-drogue IFR tankers reportedly designated H-6DU. Unlike the PLAAF's standard HY-6 tankers, they retain a fully glazed navigator's station in the nose and the deep chin radome associated with the missile strike role. The H-6DU was likewise fielded in the mid-1990s with the PLANAF's 9th Division at Lingshui, Hainan Province, primarily for supporting the PLANAF's J-8D fighters.

HD-6 ECM aircraft

An ECM version of the H-6 – the Chinese counterpart of the Tu-16PP – was also developed. Designated HD-6, it had a similar (but larger) canoe fairing under the centre fuselage; unlike the Tu-16PP, however, the HD-6 had a 'solid' nose combined with an H-6D-style chin radome.

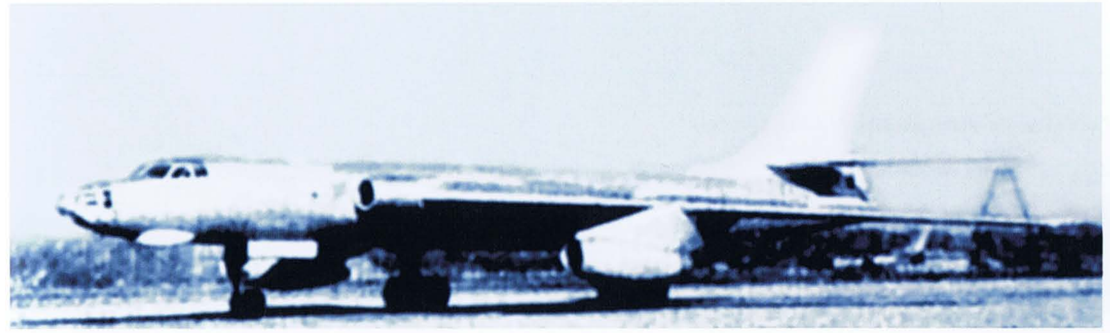
H-6 drone launcher version

This is an H-6 bomber specially modified for launching the Ba-6 high-speed, high-altitude target drone. One or two such drones could be carried (on the fuselage centreline or under the wings, respectively). Again, no exact designation is known.

H-6 engine testbed

One H-6 bomber serialled '086 Blue' (later '86 Blue') was refitted as a flying testbed for new jet engines. In the same manner as on the Soviet Tu-16LL engine testbed, the development engine was housed in a special nacelle suspended in the bomb bay; it was semi-recessed on the ground, extending clear of the fuselage and its turbulent boundary layer before start-up. Unlike the Tu-16LL, the Chinese testbed appeared to have an icing test function, with what looked like a water sprinkler grid mounted a short way ahead of the development engine's air intake.

'086 Blue', the H-6 engine testbed with the development engine nacelle deployed.



The only known photo of the H-6 I experimental version powered by four RR Speys.

H-6 I development aircraft

In the late 1970s an experimental version known as the H-6 I was developed. In an attempt to improve the bomber's range the Chinese designers replaced the thirsty WP-8 turbojets with four less powerful but more fuel-efficient Rolls-Royce RB.163-25 Spey 512 non-afterburning turbofans rated at 5,416 kgp (11,940 lbst). Two of these replaced the standard WP-8 turbojets, breathing through smaller circular intakes, and the other two were installed in pylon-mounted nacelles under the wings at about half-span.

The re-engined aircraft showed promising results; in particular, range was improved from the standard H-6's 5,760 km (3,579 miles) to 8,060 km (5,008 miles). Yet for reasons unknown the H-6 I was abandoned. Some sources say that attempts to reverse-engineer the Spey failed, leaving the bomber without a powerplant; others maintain that the Spey 512 was to have been replaced by the afterburning Spey 202 on the production version, but it transpired that this would require so much time that the idea was dropped.

H-6H missile strike aircraft

In the early 1990s, as it built up its strategic strike potential, China sought to purchase the more advanced Tupolev Tu-22M3 (NATO reporting name *Backfire-C*) from Russian Air Force stocks. However, the deal never materialised; either the parties failed to reach an agreement on the price or the Russians thought better of it, deciding that selling *Backfires* to the PLAAF was a bad idea. Hence China had to 'make do and mend', using new technologies – first and foremost 'smart' weapons' – to give the venerable H-6 a new lease of life. This helped meet new PLA doctri-

A model of the projected H-8 I bomber with four WS-6 turbofans in underwing pods.

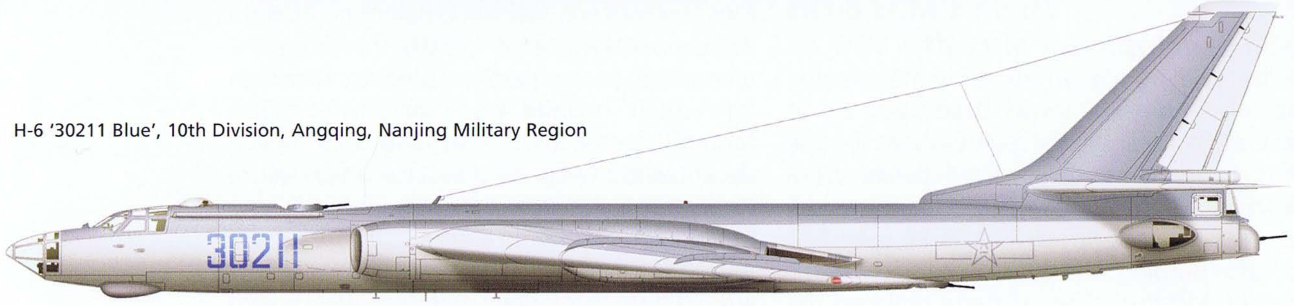
nal goals by producing a higher technology weapon to win 'local wars under high-tech conditions', like against Taiwan, but that did not necessarily assume an all-out confrontation with the United States.

The Xi'an Aircraft Company (XAC) resumed H-6 production in the late 1990s to meet the PLA's requirements for an aerial platform to deliver new stand-off PGMs. Designated H-6H, the new version differed outwardly from the H-6D in featuring a dielectric teardrop fairing aft of the bomb bay featuring a command link antenna for the PGMs. All defensive armament was removed to make room for electronic equipment.

H-6 '40672 Red', a 36th Division aircraft, is seen here carrying the Shenlong (Divine Dragon) experimental suborbital launch space vehicle in 2007.

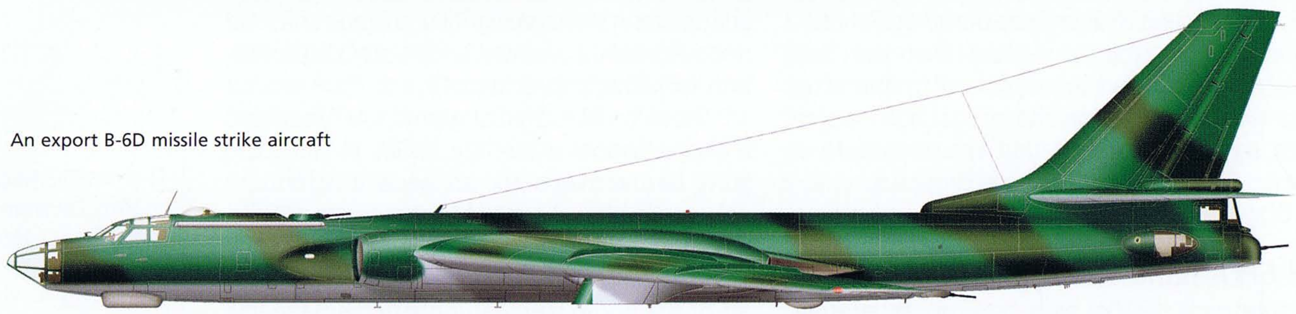
H-6 '50674 Blue outline' with low-viz markings, 36th Division, Lanzhou Military Region

H-6 '30211 Blue', 10th Division, Angqing, Nanjing Military Region



H-6D '10897 Blue', 8th Division, Leiyang, Guangzhou Military Region

An export B-6D missile strike aircraft



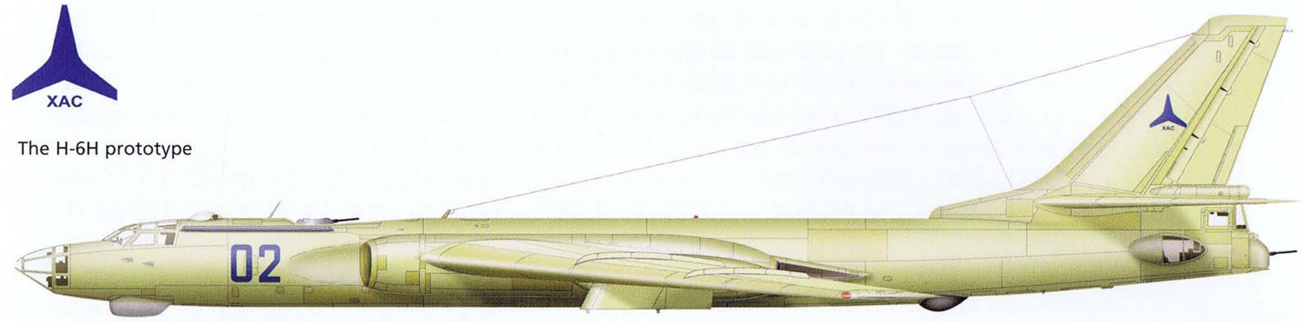
The H-6H carried two land attack cruise missiles (LACMs) under its wings; the designation is not known for certain, although various sources report the designations KD-63 (KongDi-63) and YJ-85. This weapon – the first such indigenous missile to give the PLAAF a tactical precision strike capability – appears to be based on the airframe of the YJ-6 ASM but has X-configuration cruciform tail surfaces and is powered by a small turbofan engine. The missile reportedly uses inertial/GPS mid-course guidance with a TV terminal guidance seeker and carries a 500-kg (1,100-lb) warhead over a range of 150-200km (93-124 miles), cruising at Mach 0.9.

The H-6H first flew in December 1998, and the first successful test launch of a KD-63 took place in November 2002. The aircraft probably entered service in 2004-05. This put the PLAAF into apposition to attack small but strategically important targets, like the entrances to the large tunnels near Hualien that Taiwan had built to hide its air forces from initial PLA attack.

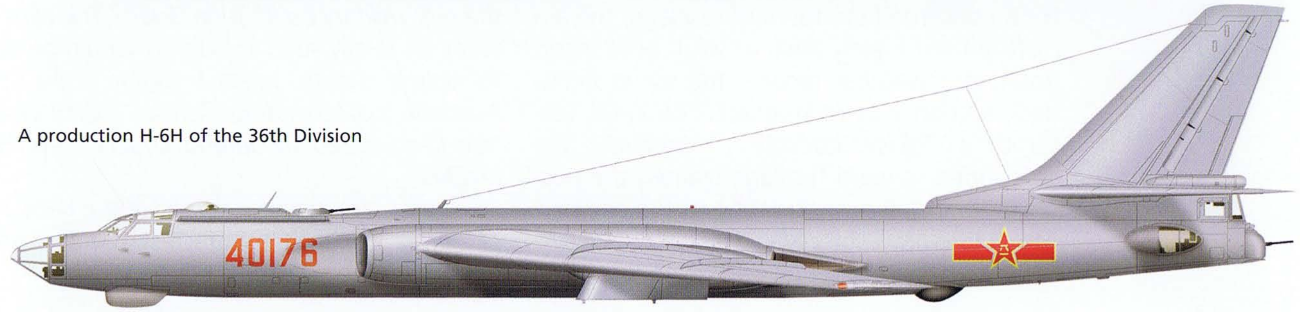
H-6M (H-6G) missile strike aircraft

A video showing tests of a new ASM carrier based on the H-6H was demonstrated at Airshow China-2002 held at Zhuhai-Sanzao airport. Designated H-6M (or H-6G), this development was characterised by four underwing pylons for carrying LACMs and the

The H-6H prototype

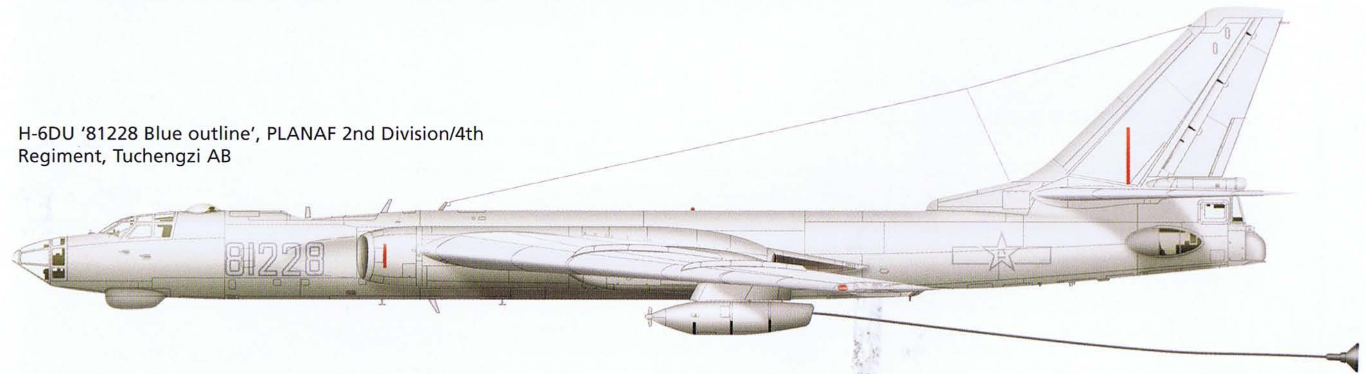


A production H-6H of the 36th Division



A PLANAF 1st Division (?) H-6M

H-6DU '81228 Blue outline', PLANAF 2nd Division/4th Regiment, Tuchengzi AB



absence of the gunner's station glazing. Apparently the new aircraft is armed with the new ASM in the YJ-8 series similar to the US AGM-84E SLAM (Stand-off Land Attack Missile) or AGM-142 Popeye missiles. It is also likely to have all-weather day/night capability.

H-6K (BC-1 God of War) missile strike aircraft

The failure of the Spey-engined derivative did not put XAC off, and another re-engined version was developed as the H-6K. Development probably began in 2000. The powerplant consisted of two turbofans mounted in the same locations aft of the rear wing spar in reworked nacelles and breathing through larger air intakes, which were circular instead of the Tu-16/H-6's distinctive quasi-triangular shape. The engine type is unknown, but there have been suggestions that 12,000-kgp (26,445-lbst) Aviadvigatel' (Solov'yov) D-30KP turbofans have been used. This engine powers the Il'yushin IL-76MD transport (NATO reporting name *Candid-B*) operated by the PLAAF in substantial numbers, and using it would make sense from a spares commonality point of view.

Assuming that D-30KP engines are indeed used, the 25% higher aggregate thrust and

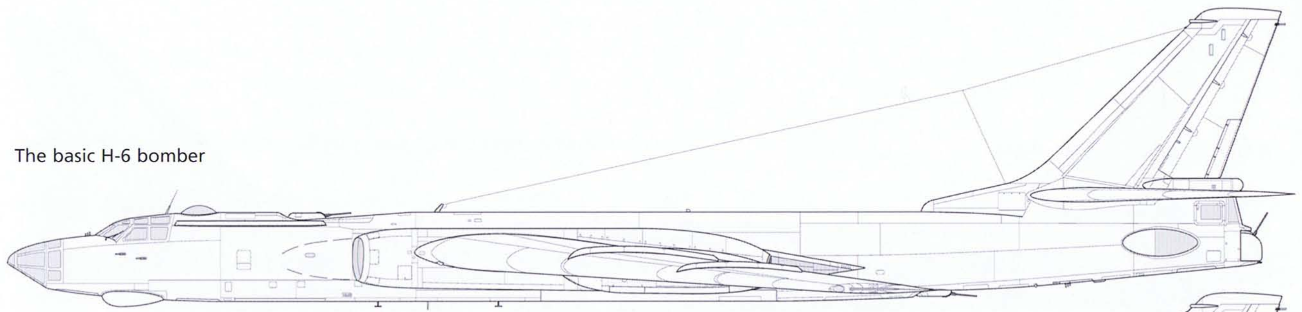
better fuel efficiency would give the bomber both a greater payload and longer range. The H-6 is now credited with a 1,800- to 2,200-km (1,120- to 1,370-mile) combat radius. Extra fuel tanks in the bomb bay would enable a 3,000-km (1,863-mile) combat radius – further extended by the estimated 1,000- to 2,000-km (621- to 1,241-mile) range of the land-attack cruise missiles carried by the aircraft.

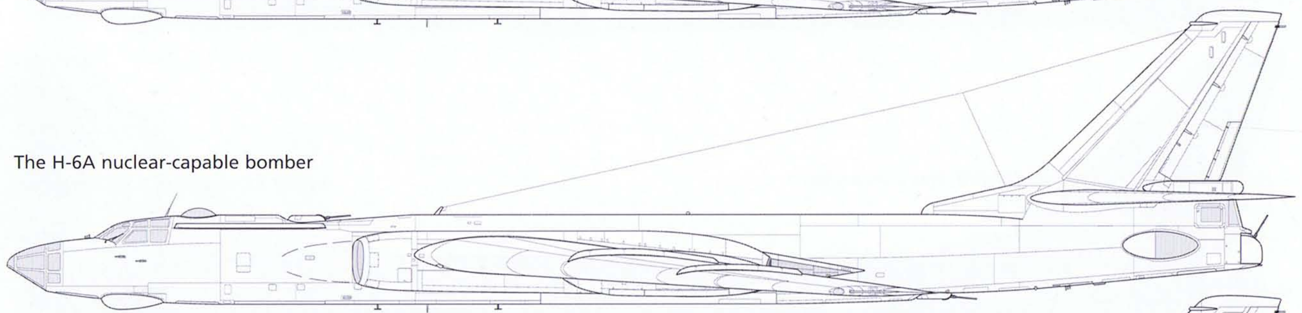
Another major change introduced on the H-6K concerned the forward fuselage; the aircraft did not merely have a 'solid' nose incorporating a weather radar – the entire flight-deck section was redesigned. The H-6K featured a 'glass cockpit'; moreover, the redesigned forward fuselage created the possibility to install new targeting optics and/or a new, more powerful radar.

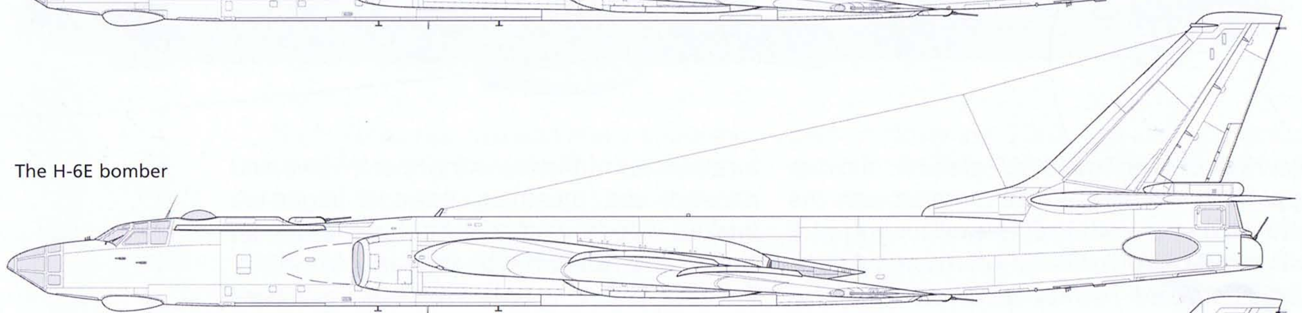
The armament could include up to six LACMs on wing pylons, or 'smart bombs' with either laser guidance (using onboard or off-board sensors) or navigation satellite guidance. With the use of six wing pylons plus internal carriage, it is reasonable to expect the H-6K to carry 14-20 of the 500-kg (1,102-lb) size guided bombs.

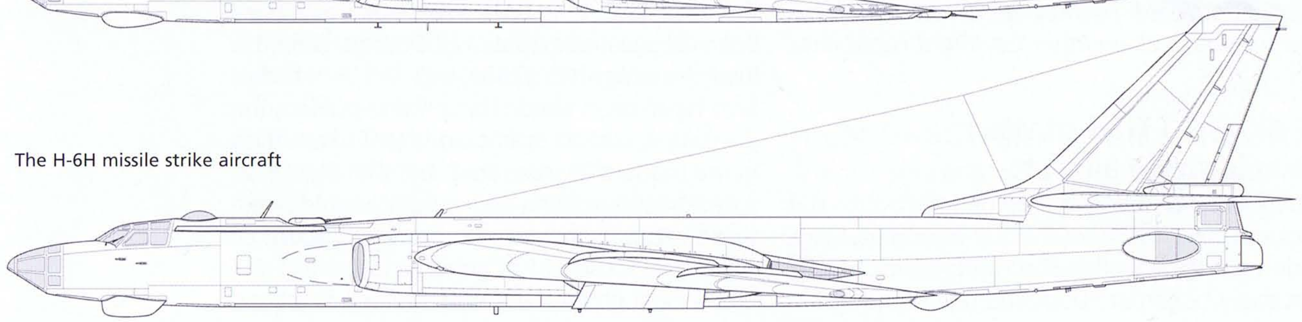
Western experts assessed the H-6K as putting China into a position to *'credibly threaten the U.S. military buildup on Guam'* The experts went on to say such an aircraft would be able to deliver strikes against Japan, India and Australia, not to mention Taiwan – all of which *'are ill-equipped to defend against new PLA LACMs'*.

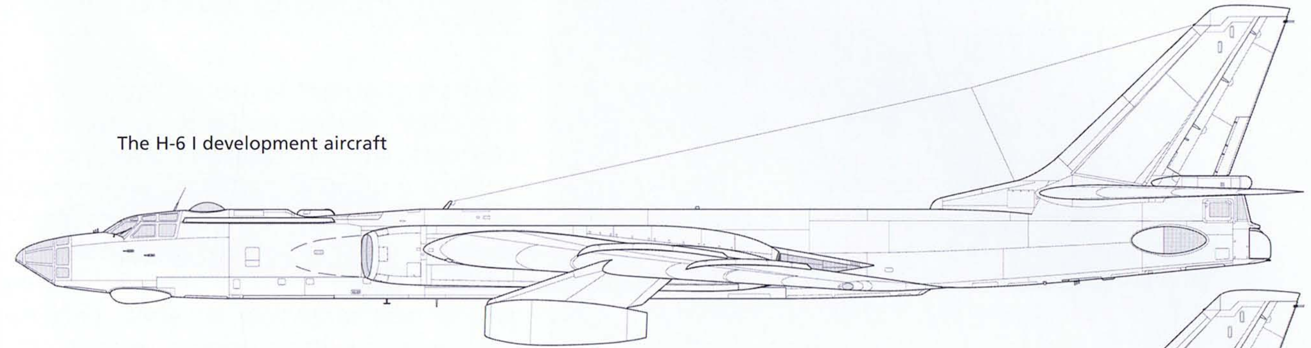
A possible second mission for the H-6K is a carrier for a suborbital launch system for space

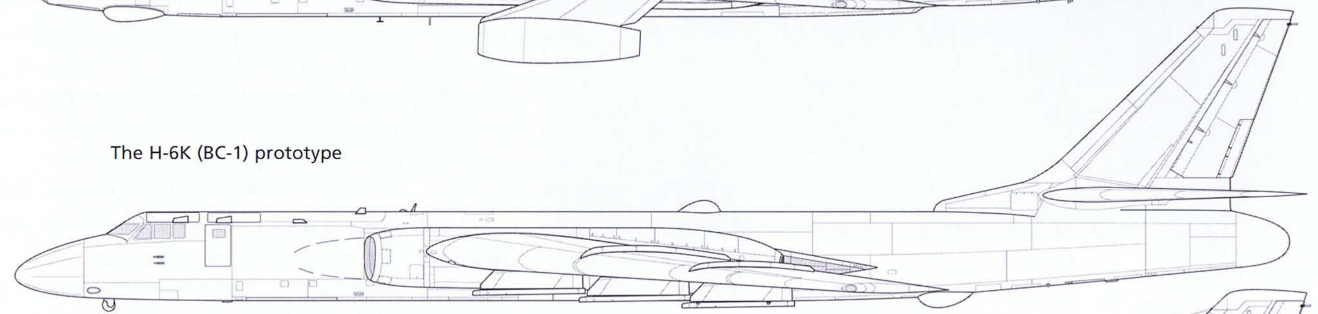

The basic H-6 bomber

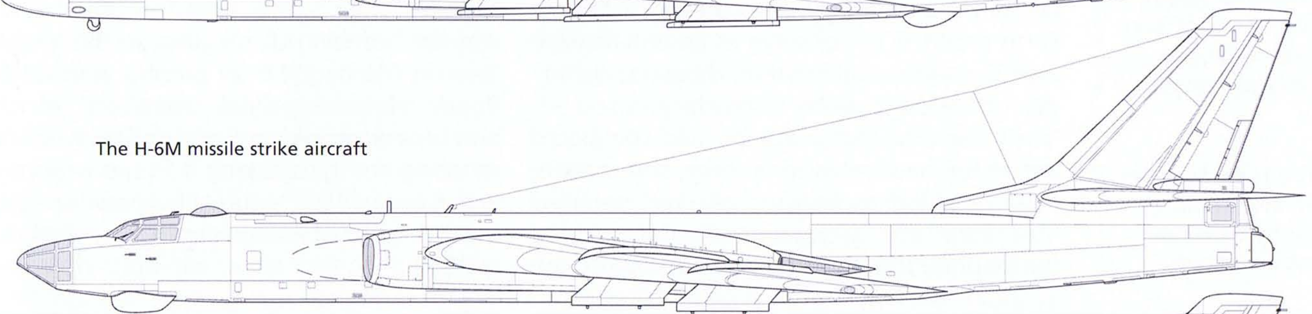

The H-6A nuclear-capable bomber

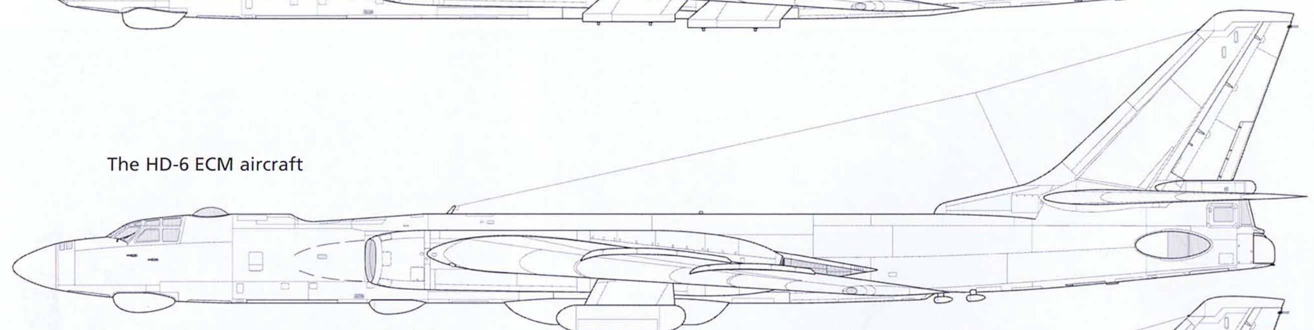

The H-6E bomber

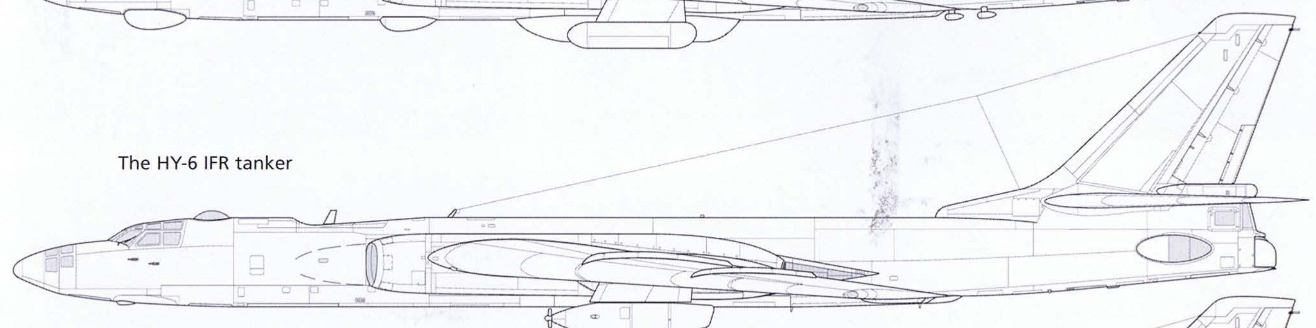

The H-6H missile strike aircraft

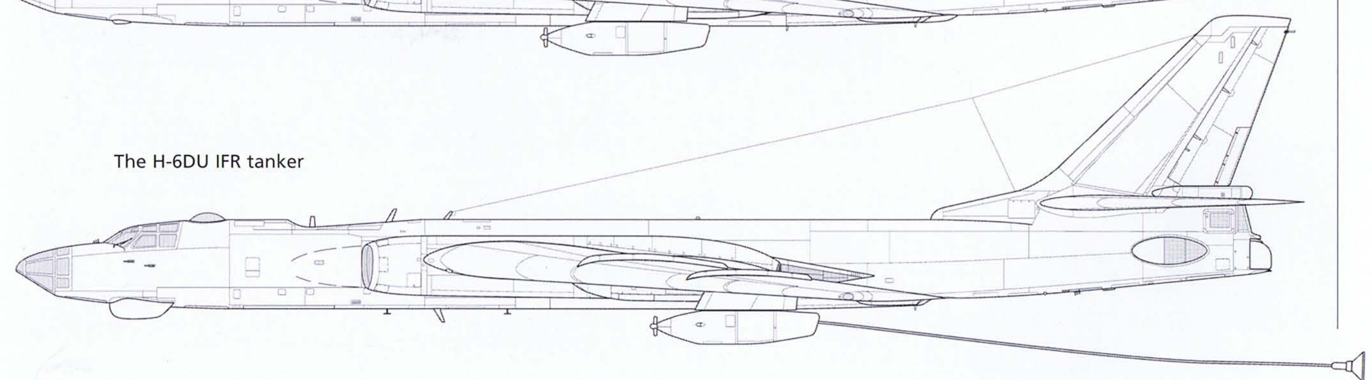

The H-6 I development aircraft

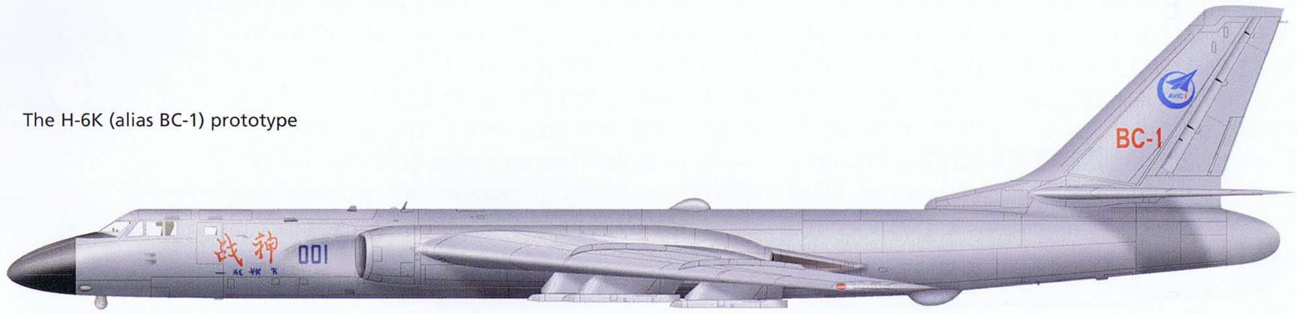

The H-6K (BC-1) prototype


The H-6M missile strike aircraft


The HD-6 ECM aircraft


The HY-6 IFR tanker


The H-6DU IFR tanker



The H-6K (alias BC-1) prototype

applications – or rather space warfare. At Airshow China 2006 the China Aerospace Corporation revealed its new Air Launched Launch Vehicle (ALLV), a solid-fuel rocket launched from an H-6 bomber. With its advertised payload of 50 kg (110 lb), the ALLV could be used for putting micro-satellites into low Earth orbit (LEO) – or serve as an anti-satellite (ASAT) weapon, a thing that China has already demonstrated its ability to create.

By the time the prototype was completed the H-6K had received a new designation, BC-1, and the name 'God of War'; serialled '001 Blue', the grey-painted prototype bore the designation BC-1 on the tail. Two large dielectric blisters were located dorsally and ventrally aft of the wings, the ventral one replacing the cannon barbette.

***

PLAAF and PLANAF H-6s were never used in anger. Probably the only case when the Chinese *Badgers* flew actual 'combat' sorties was the bombing of ice jams on the Yangtze River in March 1995 to prevent a disastrous flood. However, small numbers of H-6 bombers were sold to Iraq and Egypt, the latter using the type during a four-day skirmish with Libya in 1977 – the only known usage of the H-6 in actual warfare. Egypt retired its H-6s in 2000.

The H-6K (alias BC-1) prototype before and after painting. Note the optronic 'turret' under the restyled nose.

The H-6K features an electronic flight instrumentation system.

Xian H-8 bomber (project)

Persisting with the idea of improving the H-6's performance, on 23rd March 1970 the Chinese government tasked the No. 603 Research Institute with developing a strategic bomber designated H-8. The aircraft was to be capable of delivering conventional and nuclear free-fall weapons or air-to-surface missiles over long range, as well as of operating at night and in adverse weather without the assistance of airborne command posts.

H-8 I bomber

The designers chose a 'quick fix' approach, retaining much of the H-6's airframe structure. The forward and rear fuselage sections were basically unchanged, except that the navigator's station glazing was tipped by a small radome. The centre fuselage and the wings were new; albeit the basic wing design was the same, the H-8 featured a conventional wing/fuselage joint without the engine housings flanking the fuselage and the inlet ducts passing through the wing torsion box. The centre fuselage section was longer than the progenitor's, making for a larger bomb bay that was 8.6 m (28 ft $2\frac{37}{64}$ in) long, 1.8 m (5 ft $10\frac{55}{64}$ in) wide and 2.72 m (8 ft $11\frac{3}{32}$ in) deep. The H-6's landing gear and the tail unit were retained.

The powerplant was completely different. The first project version, designated H-8 I, had four 11,026-kgp (24,308-lbst) WS-6Jia (Type 910) non-afterburning turbofans in pylon-mounted nacelles located outboard of the main landing gear fairings. An alternative version powered by six 8,175-kgp (18,020-lbst) Pratt & Whitney JT-3D-3B non-afterburning turbofans also came into consideration.

The overall dimensions of the machine were increased. The H-8 I was to be 48.5 m

A model of the H-6K (BC-1) showing the six missile pylons.

'9053 White', one of the PLANAF's Qing-6 flying boats (Be-6s refitted with WJ-5A turboprops).

A not-so-sharp but interesting shot of the same flying boat on the slipway.

(159 ft $1\frac{29}{64}$ in) long, with a wing span of 46.47 m (152 ft $5\frac{33}{64}$ in). The maximum ordnance load was to reach 18,000 kg (39,680 lb), half of which was to be carried externally on pylons under the inner wings.

The PLAAF Museum boasts a Qing-6. Originally it wore a late-style white colour scheme as '98706 Red'.

Later, the flying boat at Xiaotangshan regained its original colours and serial.

H-8 II bomber

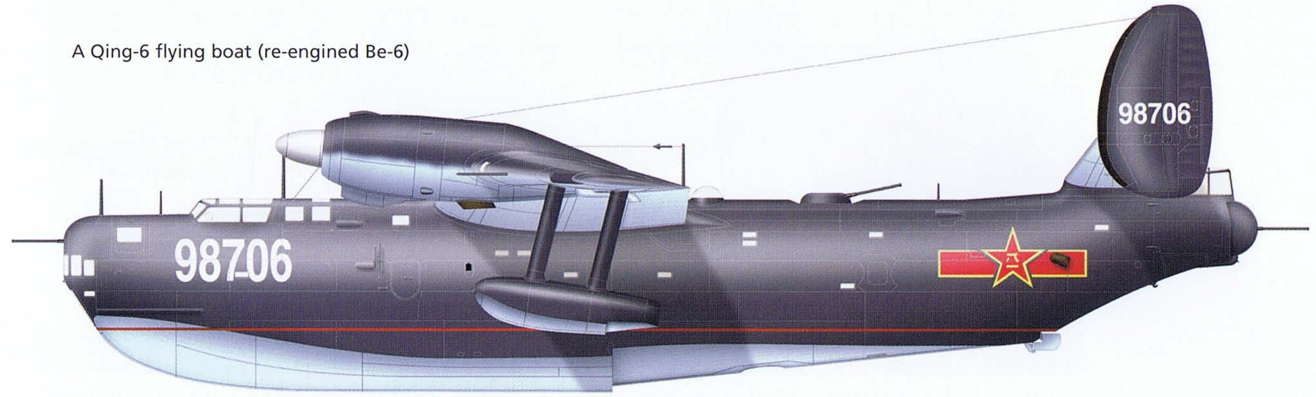
An even more ambitious project was the H-8 II – an even larger bomber powered by six WS-6Jia turbofans; the engine nacelles were spaced equally along the span so that the inboard ones were located inboard of the main gear units. The overall length and wing span were even greater. Some drawings show a redesigned flightdeck section with an extended 'solid' nose. Very little information is available about this project; anyway, the H-8 never materialised.

Beriyev Be-6 flying boat – Chinese conversion (Qing-6)

The People's Republic of China's extended coastline and vast territorial waters created the need for a seaplane force that would fill the maritime patrol/strike and anti-submarine warfare (ASW) roles. This was just about the only option until shore-based bombers with acceptable range and anti-shipping missiles came on the scene.

In the early 1960s the PLANAF received 20 second-hand Beriyev Be-6 flying boats (NATO reporting name *Madge*). The Be-6 was a fairly

A Qing-6 flying boat (re-engined Be-6)



large aircraft with a single-step hull, distinctive gull wings (a means of increasing the propeller clearance) and twin vertical tails mounted at the tips of a strongly dihedral tailplane. The fixed outrigger floats were mounted on tandem I-struts. Power was provided by two 2,400-hp Shvetsov ASh-73TK radials driving V3-A3 four-bladed propellers. The Be-6s transferred to China all represented the basic bomber version featuring a tail gunner's station in addition to the nose and dorsal turrets.

The scenario of the Tu-4 bomber was repeated: in the 1970s, as the engines ran out of service life, several Be-6s were re-engined with 4,250-ehp WJ-6 turboprops driving J17-G13 propellers. This time the nacelles were completely redesigned, and no 'bottle effect' resulted. An auxiliary power unit (APU) was also installed in the rear part of the hull for engine starting – a useful feature when afloat. The flying boats thus modified bore the local designation Qing-6.

Harbin SH-5 bomber/ ASW flying boat

Upgrade or no upgrade, the Chinese Navy was aware that the small fleet of used Be-6s would not last long and a replacement was needed. Given the political situation of the mid-1960s, this could only be an indigenous bomber seaplane. Therefore in 1968 a special Seaplane Design Institute was established. At the end of the year the new institute submitted the concept of an aircraft designated SH-5 (*Shuishangji Hongzhaji* – maritime bomber), which was approved by the government in December.

'9133 Red', one of the four production SH-5 flying boats. Note the powder stains near the cannon turret.

The final production SH-5 with beaching gear extended

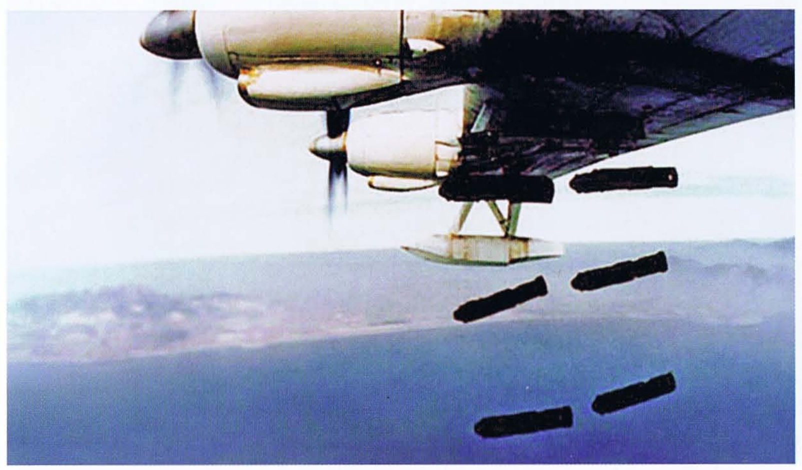
Inevitably, the SH-5 drew on the design of the Be-6, incorporating similar features in the design of the airframe. However, the layout was markedly different. Most notably, the Chinese flying boat had conventional shoulder-mounted wings with anhedral on the outer sections instead of gull wings. Also, the horizontal tail had less dihedral and the entire tail unit was mounted on a sort of faired podium on top of the rear hull. The shape of the planing bottom also differed – the bows portion featured splash suppressor slots and spray dams.

'9113 Red', the first production SH-5, immediately after becoming airborne.

The powerplant consisted of four 2,900-ehp WJ-5A-1 turboprops (a Chinese derivative of the Ivchenko AI-24V) manufactured by the Dong'an Engine Factory in Harbin; the engines drove Baoding J16-G10A four-bladed reversible-pitch propellers (the licence-built version of the AV-72) of 3.9 m (12 ft 9½ in) diameter. The engine nacelles adhered to the underside of the wings so that their tops were level with the wings' upper surface.

An important new feature introduced on the SH-5 was a retractable tricycle beaching gear replacing the Be-6's detachable beaching gear which was rather inconvenient to remove and install. This was not really a landing gear, as it was not stressed for operation from shore runways; therefore the SH-5 cannot be regarded as an amphibian. Nevertheless, the gear allowed the machine to come ashore under its own power. All three units retracted aft; the twin-wheel nose unit was closed by double doors that formed part of the planing bottom while the single-wheel main units rotated outward and upward so that the wheels lay flush with the sides of the hull, the gear struts being horizontal (as on the Japanese Shin Meiwa PS-1/US-1 amphibian).

An SH-5 drops free-fall bombs from the wing pylons during an exercise.



The mission equipment was vastly improved to reflect the current standards for maritime patrol/ASW aircraft. Unlike the Be-6, the SH-5 had a thimble-like projection at the bows carrying a search radar, in the manner of the Beriyev Be-12 Chaika ASW amphibian (NATO reporting name *Mail*); this 'thimble' also incorporated the glazing of the navigator/bomb-aimer's station. The tail gunner's station gave place to a long magnetic anomaly detector (MAD) 'stinger'.

The SH-5 could be used against both surface ships and submarines, carrying bombs, mines, torpedoes (up to four), depth charges (up to 22) and sonobuoys in an internal weapons bay and on underwing pylons. The maximum ordnance load was 6,000 kg

'9143 Red', the final SH-5, pictured immediately after alighting.

(13,230 lb), of which only 1,000 kg (2,205 lb) were carried internally. The defensive armament was restricted to one remote-controlled dorsal turret aft of the wings mounting two 23-mm Type 23-1 cannons. The aircraft had a flight crew of five and a mission crew of three.

The detail design stage was completed in February 1970 and the manufacturing drawings were issued to the Harbin Aircraft Factory, which was selected to build the SH-5, in March-October that year. The plant utilised new manufacturing techniques in the flying boat's production process, such as bonding, sealed riveting and chemical milling.

The first airframe (c/n 01) completed in October 1970 was the static test article, which was delivered to the Aircraft Structure Analysis Research Institute; the static tests continued until August 1974. Painted dark blue overall and wearing white chequerboard photo calibration markings, the prototype ('02 White', c/n 02) was completed in December 1973. It was not until October 1974 that the machine was delivered to the flight test facility where it underwent ground checks and water taxi trials; 30 hours of waterborne tests had been accumulated between May 1975 and March 1976. The programme was making slow progress because the designers were breaking new ground (or should we say 'sailing new water'?) with the SH-5.

On 3rd April 1976 the SH-5 finally made its long-delayed 23-minute first flight. The crew was captained by Huang Xinhui, a PLANAF squadron leader. The flight tests then dragged on so long that the Navy decided against the completion of the second prototype (c/n 03).

Four production SH-5s (c/ns 04 through 07) had been built in Harbin by the end of 1984. As compared to the prototype the production version incorporated a number of changes; the most obvious ones were the outrigger floats mounted on tandem V-struts instead of I-struts, a roomier flightdeck extended aft, and a reshaped nose with a DPL-1 (Type 773) navigation radar in a bigger and more rounded radome. There were plans to equip the aircraft with a French ASW suite taken from the Bréguet 1150 Atlantic. Serialled '9113 Red', '9123 Red', '9133 Red' and '9143 Red', the four aircraft underwent additional tests in Hubei and Hunan Provinces in 1985. Upon completion of the trials they entered service with the 3rd Independent Naval Air Regiment at Qingdao.

The reader may wonder why the results were so meagre. Apart from the effects of the 'Cultural Revolution' and China's lack of experience in seaplane design, the SH-5 was victimised by the unavailability of its intended principal weapon. From the outset the flying boat was envisaged as a carrier for the YJ-1

Two production SH-5s await delivery at Harbin in company with the prototype, '02 Red'; note the difference in colour schemes.

An SH-5 pictured during the take-off run.

(alias C-101) ramjet-powered supersonic anti-shipping missile. However, this missile ran into development problems that proved insurmountable, showing insufficient range, and in 1980 the Navy abandoned its plans to equip the SH-5 with the YJ-1. That left the aircraft with only free-fall weapons; that is, the SH-5 was adequately armed and equipped for low/medium-altitude patrol missions but not for the envisaged long-range anti-shipping strike missions. Besides, the SH-5 was underpowered and its flight performance was inadequate. As of this writing the type remains in service, but the PLANAF is reportedly considering replacing it with an ASW version of the more capable Russian Beriyev Be-200 twin-turbofan amphibian.

The aircraft was 38.9 m (127 ft 7½ in) long, with a wing span of 36.0 m (118 ft $1\frac{21}{64}$ in) and a wing area of 144 m^2 (1,548 sq ft), and stood 9.802 m (32 ft $1\frac{29}{32}$ in) tall on its beaching gear. The normal and maximum take-off weight was 35,000 kg (77,160 lb) and 45,000 kg (99,210 lb) respectively. The service ceiling was 7,000 m (22,965 ft); the SH-5 reached a top speed of 556.6 km/h (345.86 mph) at 6,000 m (19,685 ft) and a maximum range of 4,906 km (3,048 miles).

SH-5A maritime patrol/ ELINT aircraft

Lately some of the SH-5s have been retrofitted for ELINT duties. Such aircraft were designated SH-5A.

SH-5B water bomber

With China's large areas of forestation, forest fires were a major problem, putting lives at risk and causing great damage to the national economy and the environment. In order to fill a need for a specialised fire-fighting aircraft, at least one SH-5 ('9133 Red') was converted into a firebomber designated SH-5B. Special tanks holding 8 tons (17,640 lb) of water were installed in the weapons bay; the aircraft could scoop up water as it skimmed along the surface and then discharge it onto the fire through two doors aft of the planing step.

'9133 Red' was converted into the SH-5B water bomber. It is seen here discharging its 8-ton load of water on a hypothetical fire.

New stealth bomber programme?

For many years there have been rumours of a new 'stealthy' Chinese bomber project, sometimes called H-9, which has been described variously as a wholly indigenous program, or one that draws extensively on former Soviet programmes that were discontinued during the 1990s, like the Sukhoi T-60S medium bomber project. The T-60S reportedly would have been a stealthy supersonic bomber with a 5,000-km (3,110-mile) range. However, the tight security surrounding current Chinese military programmes means such rumours cannot be confirmed.

4 The Strike Aircraft

A number of specialised attack aircraft and fighter-bombers were developed in China for providing close air support to ground forces and destroying pinpoint ground or maritime targets.

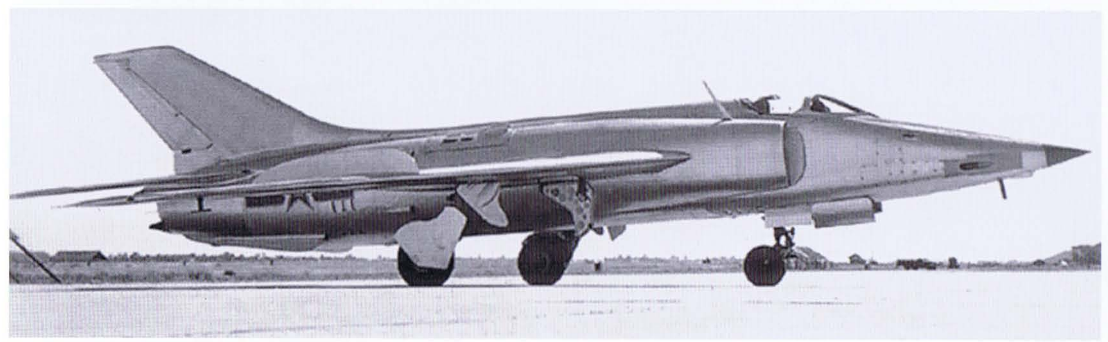
Nanchang Q-5 (A-5) attack aircraft

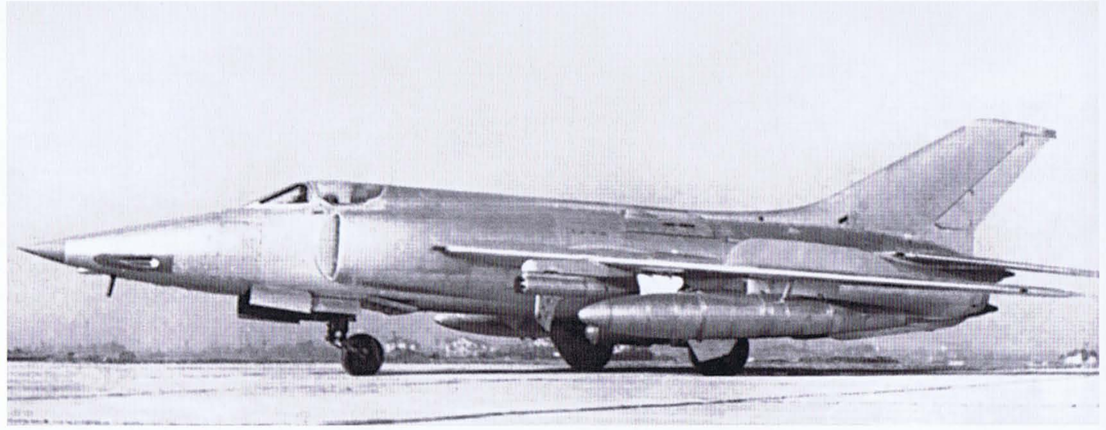
When the MiG-19S first became available to the PLAAF in 1958 it was as modern a fighter as you could wish for at the time; yet, it was not effective enough as a fighter-bomber – a type the PLAAF needed urgently. It was decided to go ahead with the development of a specialised 'mud mover', using the MiG-19S (J-6) as a starting point.

The story of this aircraft began in 1955 when China clashed with Taiwan in armed conflict for the Yijang-Shan Island – and captured the latter. Although the PLAAF's Il'yushin IL-10M ground attack aircraft (NATO reporting name *Bark*) flying close air support (CAS) missions for the Chinese marines coped with their task, it was clear that a jet attack aircraft with supersonic performance was needed urgently.

The Shenyang aircraft factory presented a preliminary design concept in early 1958; incidentally, the students of the Shenyang Aviation Institute had a hand in the design process. In August of the same year Wang Xiping, Director of the Aviation Industry Bureau, and his deputy Xu Changyi decided that development of the attack aircraft should

The first prototype Q-5 (c/n 02); note the placement of the cannons in the nose.





The third Q-5 prototype (c/n 04) with drop tanks and FAR pods. The cannons have been moved to the wing roots.

be undertaken by the Nanchang factory (which had by then gained some experience with jets). Development of this aircraft initially designated XionYing-302 (Mighty Eagle-302) but soon renamed Q-5 (*Qiangjiji* – attack aircraft) began in August 1958 under the supervision of Lu Xiaopeng, the factory's Vice Director. A team of ten Nanchang factory engineers, including Vice Chief Engineer Feng Xu and section director Gao Zhenning, was sent to Shenyang to work on the general layout.

Building on the PLAAF's operational requirements and attack aircraft development trends, the engineers at Nanchang believed

the future aircraft's main role would be CAS. To this end the fighter-bomber needed good low-altitude performance and plenty of firepower, as well as some potential as a dogfighter for self-defence, good field performance and adequate range and endurance.

Despite the demand for maximum structural commonality with the original J-6, the Q-5 was virtually a new airframe. The fuselage was completely redesigned and some 25% longer, with new forward and centre sections; only the aft fuselage remained relatively unchanged. The bifurcated nose air intake gave place to a long pointed nose giving a better view downward; the nose housed avionics, with a view to possibly installing a radar later on. The engines now breathed through oval-section lateral intakes flanking the cockpit, with short boundary layer splitter plates. This more draggy arrangement, coupled with the higher gross weight, reduced the Q-5's top speed substantially (by Mach 0.23), as it turned out. The canopy was much shorter and aft-hinged, not sliding. The cockpit featured armour protection against small-arms fire.

The centre fuselage was area-ruled to cut transonic drag and incorporated a small internal weapons bay about 4 m (13 ft 1½ in) long

An initial production Q-5 with gun blast plates added. Note the open airbrakes.

Q-5 '70800 Red' of the PLAAF 50th Division taxies out with heavy unguided rockets on the inboard pylons.

A string of Q-5s parked in single file while the pilots discuss flying matters.

which was the real reason for this extensive redesign. This could accommodate, e.g., four 250-kg (551-lb) HE bombs or a single 5- to 20-kiloton nuclear bomb and was flanked by bomb racks for carrying two more bombs; the maximum ordnance load was specified at 2,000 kg (4,409 lb). A large ventral airbrake was located ahead of the weapons bay and the twin lateral airbrakes on the aft fuselage were relocated. The single ventral fin of the MiG-19 gave way to outward-canted twin strakes.

The wings were superficially similar to those of the *Farmer* but swept back 52°30' at quarter-chord instead of 55° to improve lift at low speed (and hence turning characteristics), featuring increased area, Gouge flaps and no roll control spoilers. The trailing edge was kinked, being at right angles to the fuselage on the inboard portions. The horizontal tail remained unchanged but vertical tail height and area was increased to offset the greater area ahead of the CG. There was a smooth transition from fin to fuselage – the MiG-19's pronounced fin fillet was gone.

'147 Red', one of the Q-5 III prototypes, with bombs on the fuselage pylons.

The Q-5 assembly line at Nanchang. The second aircraft from camera is c/n 14-17.

The Q-5 I's weapons, including FFARs, retarded bombs and napalm tanks.

To make the most of the available space in the forward avionics bay the forward-retracting nose gear unit was redesigned so that the wheel rotated through 87° during retraction to lie flat in the nosewheel well which was slightly offset to port. The main gear units had fat low-pressure tyres. The Q-5 retained the MiG-19's (J-6's) powerplant – two 3,250-kgp (7,165-lbst) Shenyang WP-6 afterburning turbojets – and the numerous cooling air scoops on the aft fuselage. The five fuel tanks (three in the centre fuselage and two in the rear fuselage) held 3,648 litres (802.5 Imp gal); provisions were made for carrying 760-litre (167.2 Imp gal) drop tanks inboard and 400-litre or (88 Imp gal) drop tanks outboard.

The built-in armament consisted of two Type 23-2K cannons with 100 rpg in the fuselage nose. This simplified reloading but was the worst possible location from an operational standpoint, since the gun blast gases were guaranteed to be ingested by the

engines, causing surge. An SH-1 optical gunsight was fitted.

A full-size mock-up of the Q-5 was constructed and shipped to Beijing for review in October 1958. Chen Geng, the Vice-Chief of the General Staff, assessed the project and approved it, clearing the way for prototype construction. This came at a time when the Bureau of Aviation Industry decided that the Nanchang factory should switch from propeller-driven aircraft to jets.

Then came the notorious 'Great Leap Forward' and the Q-5 fell victim to it: some of the young and zealous engineers pushed the design process at an utterly unrealistic pace. In February 1959 a complete set of manufacturing drawings and documents (numbering more than 15,000 pages!) was released to the experimental shop at Nanchang in record time – just 75 days (!) after detail design had begun. However, the drawings were unsatisfactory (e.g., wind tunnel tests revealed major problems) and had to be reworked no fewer than four times before they were acceptable. The 20,000-page final version of the manufacturing drawings and wind tunnel test reports were issued in May 1960. Also, some of the specified materials and equipment were unavailable in China or could not be developed in a short time frame.

In 1961, when prototype construction was under way, the Q-5 programme was cancelled due to financial difficulties in the aftermath of the Great Leap Forward, the 300-strong design team was disbanded and the prototype production line dismantled. Lu Xiaopeng and Feng Anguo, Director of the Nanchang aircraft factory, refused to put up with this and eventually got the programme reinstated two years later. However, they were authorised to proceed with a design team of only fifteen engineers and use only 'bits of time and space available'; in a nutshell, the Q-5 was now regarded as a very secondary matter.

Nevertheless, the Q-5 refused to die. Lu Xiaopeng and his team not only made drawings and calculations but did a lot of footwork, trying to find subcontractors who were willing to co-operate. When Deputy Minister of Aircraft Industry Xue Shaoqing visited the factory and checked on progress, the programme was suddenly back in favour and development was speeded up. The development work continued – with more spills. The first static test airframe failed at 85% of the nominal load on 26th October 1963, the fuselage breaking in

White-painted Q-5 Is parked at a PLAAF base show the dorsal location of the brake parachute.

Three PLANAF 5th Division/14th Regiment Q-5 Is. Note the formation keeping markings on the wing fences and the fuselage (the pilot positions his aircraft so that the arrows on the lead aircraft are matched and the arcs form a perfect circle).

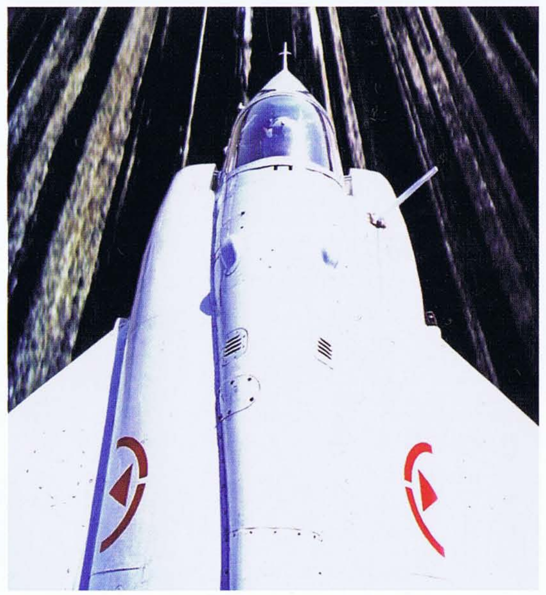
'0064 Red', an early Q-5 with ventral brake parachute bay, at the PLAAF Museum.

two; the structure had to be reinforced and the static tests repeated. This mishap even led Minister of Aircraft Industry Sun Zhiyuan to visit Nanchang and get a full report.

The unserialled first prototype Q-5 (c/n 02) took to the air on 4th June 1965 with test pilot Tuo Fenming at the controls. A provisional type certificate was awarded same year after only 25 hours of flight tests. On 10th March 1966 the aircraft was demonstrated to Ye Jianying, Vice Chairman of the Military Commission of the Central Committee of the Communist Party. The big shot was very impressed.

Still, the trials showed that numerous changes needed to be made. Thus, the aircraft had a tendency to pitch down when the airbrakes were deployed. Starting with the unserialled third prototype (c/n 04), the cannons were relocated to the wing roots in order to prevent gun blast gas ingestion; the cannons had blast plates with a complex shape (rectangular with a small semi-circular projection at the front. Over the next two years, improvements were made to the hydraulics, fire control system, fuel system and so on.

The modification process dragged on for more than four years and the second and third prototypes were not flown until October 1969. At the end of the year the Q-5 was finally deemed satisfactory and series production at Nanchang began – ten years and four months (!) after the design process had com-



The forward and centre fuselage of a Q-5 I.

menced. This was the epitome of the Great Leap Forward which boiled down to 'haste makes waste'. The Q-5 was the first indigenously designed Chinese combat aircraft to achieve production. Incidentally, in the Soviet Union a similar transformation of a tactical fighter into a strike aircraft (the MiG-23 to MiG-27 evolution) did not take place until much later.

The type entered service in 1970, when Sino-Soviet relations were at their worst; hence the Q-5 was supplied primarily to the units stationed in northern China which would be the first to engage the Soviet Union in the event of an armed conflict. By 1978 production had almost ended, as the PLAAF's needs had been satisfied, continuing at a low rate only to make up for attrition losses. In the West the aircraft was misidentified first as the F-6*bis* and then as the F-9 before the correct designation became known in 1980. The Q-5 was assigned the NATO reporting name *Fantan* (a Chinese gambling game).

An impressive row of PLAAF 5th Division/13th Regiment Q-5 Is at Weifang AB.

Q-5 I attack aircraft

One of the original Q-5's most serious shortcomings was its very limited range. Hence Gao Zhenning proposed to develop an extended-range version to meet a PLAAF specific operational requirement (SOR) issued in 1976. This came to be known as the Q-5 I ('Q-five-one').

'10260 Red', a13th Regiment Q-5 I. The formation keeping markings seem to be standard for this version.

Two 13th Regiment Q-5 Is take off, carrying practice bombs on the forward fuselage pylons.

Q-5A nuclear bomb carrier

In 1970 the Nanchang factory adapted a number of Q-5s into nuclear-capable tactical bombers to support China's tactical nuclear weapon development programme, which was making slow progress. Also referred to as the Q-5A, the nuclear bomb carrier could be identified by the open recess for the nuke lacking bomb bay doors and by the all-white colour scheme intended to protect the aircraft from the flash of the nuclear explosion.

The Q-5A prototype entered flight test on 1st August 1970 (incidentally, 1st August is the birthday of the PLAAF). A small quantity of Q-5As was built. One such aircraft was used to perform China's 13th nuclear test at Lop Nor on 7th January 1972.

Simultaneous bomb delivery by a quartet of Q-5s.

The internal weapons bay which proved to be extremely impractical (it was simply too small) was put to good use, housing an extra fuel tank in lieu of bombs. This increased the Q-5 I's internal fuel capacity by 70% over the J-6 (to 3,720 litres/818.5 Imp gal), improving range by 26% and combat radius by 35% – no small achievement.

To compensate for the deletion of the weapons bay two pairs of pylons were installed in tandem under the fuselage, allowing the ordnance load to be increased by 500 kg (1,102 lb). Uprated WP-6A III engines were installed in place of the original WP-6s. In similar manner to the J-6C the brake parachute housing was moved from its ventral position to the base of the rudder, resulting in a 130-m (426-ft) reduction of the landing run. The landing gear was reinforced, a new ejection seat was installed and a new short-wave radio fitted.

Five prototypes were built in 1977, taking part in the certification tests which lasted until the end of 1980. On 20th October 1981 the National Defence Industry Office of China's State Council granted a formal type certificate to the Q-5 I.

Some Q-5 I fighter-bombers operated by the PLANAF were outfitted to carry YJ-8 (C-801) anti-shipping missiles on underwing pylons. Such aircraft featured a Doppler speed/drift sensor system.

Q-5 IA attack aircraft

This aircraft ('Q-five-one-a') was a further improved version of the Q-5 I. It introduced pressure refuelling instead of gravity refuelling, an RHAWS, the capability to carry FFAR pods and various new types of bombs. A Type 79Y4 laser rangefinder and a new SH-1 I gun/bomb sight were fitted, and a Type 205 Doppler navigation system increased navigation accuracy (this system was not fitted in production).

The aircraft entered flight test in 1979, and trials continued until October 1983. The engineers managed to iron out some of the Q-5's bugs, such as the tendency of the cannons to jam and the serious errors in the air data system readings. The Q-5 IA was certificated in 1985.

Two Q-5 Is carrying drop tanks and unguided rockets 'clean up' on take-off. The serials have been removed by the military censor.

'80572 Red', the first prototype Q-5B, had an all-metal nose.

Q-5 II (A-5B) attack aircraft

Production was reinstated when Pakistan showed an interest in the Q-5 in 1981. The first export version was designated Q-5 II or A-5B (A for attack aircraft); deliveries of the 42 aircraft ordered by the Pakistan Air Force commenced in February 1983. It featured a number of changes, including a further improved SH-1 II gun/bomb sight and an HK-15 laser rangefinder.

Serialled '10769 Red', the prototype Q-5 II was apparently converted from the 15th production Q-5 (c/n Q5-015). Besides being operated by the PLAAF, the type was exported to North Korea (the first foreign customer) and Pakistan.

Q-5 III (A-5C) attack aircraft

The second export version of the Fantan designated Q-5 III (A-5C) was a derivative of the Q-5 I. It incorporated 32 modifications of varying importance. The most significant ones were the Martin-Baker PKD10 zero-zero ejection seat and the new weapons pylons which were compatible with Western bombs and missiles, including the AIM-9 Sidewinder. Two bomb pylons were added in line with the drop tank hardpoints and two missile rails outboard of them (as on the J-6 IV or F-6s upgraded in Pakistan). Typical weapons included seven-round pods for 90-mm (3.54-in) FFARs, four-round pods for 130-mm (5.11-in) FFARs, low-drag HE bombs and Zhuzhou PL-7 AAMs (a copy of the Matra R-550 Magic).

The development contract was signed in April 1981. Three prototypes were built, logging 101 hrs 37 min of flight test time between them by the time certification was obtained in January 1983. By early 1987 the Pakistan Air Force had taken delivery of about 100 A-5Cs.

'31124 Red', another Q-5B prototype, at the PLAAF Museum.

The Q-5B experimental torpedo-bomber with a drooped nose incorporating a large radome.

Q-5 III '145 Red' with a typical Chinese mix of weapons, including PL-7 AAMs.

An export A-5C in AVIC demonstrator colours.

The Q-5 III's typical warload in PLAAF service was four 100-kg (220-lb) HE bombs on the fuselage stations, two seven-round FFAR pods on the inboard wing pylons, two 760-litre (167.2 Imp gal) drop tanks on the centre wing stations and two PL-7 AAMs outboard. Chinese Navy aircraft, in contrast, were armed with two FFAR pods, two C-601 anti-shipping missiles on the centre wing stations and carried 400-litre (88 Imp gal) on the outermost pylons. Pakistani A-5Cs typically carried four Durandal runway-cratering bombs on the fuselage stations, two 760-litre drop tanks and two AIM-9P AAMs.

An A-5C displays its impressive warload of low-drag bombs, unguided rockets and PL-7 AAMs.

An unusually camouflaged Q-5 I at the PLAAF Museum.

Q-5B torpedo bomber

This was one of the more unusual developments of the *Fantan*. After experimenting with a J-5 (MiG-17) converted into a makeshift torpedo bomber the Chinese engineers decided to try adapting the more capable Q-5 for this role, since it was operated by the Navy as well.

Development began in 1969. The entire forward fuselage ahead of the air intakes was redesigned; the cockpit was raised and the nose drooped and rounded to improve downward visibility; this incorporated a Type Jia-13 radar. The new nose altered the aircraft's profile dramatically, making the Q-5B seem shorter and stockier. A new KJ-45 autopilot and a Type 45 fire control system were envisaged.

The prototype ('80572 Red', c/n 01) made its maiden flight on 29th September 1970 with Tan Shikun at the controls. Apparently, however, the modification was unsuccessful

3W 156, the latest known Pakistan Air Force A-5C, over rugged mountains near Peshawar.

PAF pilots of No. 16 Sqn 'Panther' pose with A-5C 3W-151 at Peshawar.

The Bangladesh Air Force also bought the A-5C; 56904 and 56911 are seen here.

A-5C '1503', one of 24 delivered to the Myanmar Air Force, at Hmawbi AB.

Sudan was another operator of the A-5C. The nearest aircraft is serialled 403.

A trio of Sudan Air Force A-5Cs, including 402 (minus rear fuselage) and 403.

and the PLANAF had to make do with Harbin H-5 torpedo bombers.

A second version of the Q-5B was to be armed with anti-shipping missiles and feature larger air intakes. Outwardly it differed from the first version in having a more bulbous nose housing a Type 317 radar in a larger radome. At least one prototype serialled '31124 Red' was tested.

Q-5D attack aircraft

The Hongdu Aircraft Industry Group began development of the Q-5D upgrade in the 1990s, possibly relying on the experience gained with the Q-5K/M. The aircraft entered flight tests in the late 1990s, and a small number was built for to the PLAAF. Such aircraft can be easily identified by the deep green colour scheme.

Little is known about the Q-5D's mission equipment. The underside of the nose features a fairing with windows for an ALR-1 laser rangefinder/marked target seeker (LR/MTS) and possibly LLLTV/FLIR. The optical systems give the Q-5D day/night capability. The aircraft is also fitted with improved avionics including a HUD, a GPS receiver/inertial navigation system, a tactical radio navigation (TACAN) system and chaff/flare dispensers. The aircraft is also said to have longer range and can carry a wider range of weapons, including Chinese LS-500J laser-guided bombs (comparable to the US Paveway I) which can be launched from a distance of up to 12 km (7.46 miles).

Q-5E/Q-5F attack aircraft

These versions have been under development since the late 1990s. The Q-5E carries a FLIR/LR/MTS pod under the fuselage, while the Q-5F has large equipment housings under the nose and centre fuselage and carries two LS-500J laser-guided bombs under the wings. The two are always mentioned together, suggesting they operate as a 'hunter-killer' pair. The exact status of this project is unknown.

Q-5J conversion trainer

A two-seat trainer version designated Q-5J (*Jianjiji* – trainer) was developed to replace the obsolete Shenyang JJ-6 used for training Q-5 crews hitherto. The trainee and instructor sit in tandem under a common canopy with individual hinged sections, and the vertical tail is enlarged to improve directional stability. The trainer's first flight took place on 28th February 2005.

Q-5K Kong Yun (A-5K) attack aircraft

An upgraded version of the *Fantan* designated Q-5K or A-5K for export was developed for the PLAAF in June 1987 in accordance with a Sino-French agreement. This version had a popular name, Kong Yun (Cloud). The aircraft was equipped with a Thomson-CSF VE-110 HUD and a Thomson-CSF TVM 630 rangefinder in a slightly cropped nose and powered by 4,600-kgp (10,140-lbst) WP-6A engines. The first prototype serialled '21092 Red' took to the air on 17th September 1991, followed shortly afterwards by the second example, '22091 Red', but the programme was abandoned in 1990 because the weapons embargo imposed in the wake of the Tiananmen Square massacre made further deliveries of the mission avionics impossible.

'20320 White', an 11th Division Q-5D, makes a scary banked touchdown.

A Q-5D deploys its brake parachute on landing.

Q-5Ds are painted dark green overall. '30393 White' is a 28th Division/82nd Regiment aircraft.

Two more 82nd Regiment Q-5Ds on the runway at Jiangqiao AB.

Q-5M (A-5M) attack aircraft

This was another avionics upgrade developed under a contract between CATIC and Aeritalia signed in July 1986; the programme was formally launched on 1st August that year. The Q-5M (modified, aka A-5M) was based on the Q-5 II and equipped with an Italian all-weather attack/navigation suite similar to that of the Aeritalia/Aermacchi/Embraer AMX fighter/attack aircraft. This was built around two Singer central digital computers and a duplicated MIL-STD-1553B databus. The avionics included an Israeli-Italian Elta/FIAR Pointer 2500 ranging radar in a small radome, a Litton LN-39A inertial navigation system, an Alenia HUD-25 head-up display, a new air data computer, an RW-30 radar warning receiver, an AG-5 attitude indicator and an AR-3201 VHF radio. Like the Q-5K, the aircraft was powered by WP-6A III engines with a TBO doubled from 150 to 300 hours.

Two extra missile rails were added under the extreme wingtips, bringing the number of hardpoints to 12. More than 22 weapons configurations have been specified. A typical weapons load comprised four US Mk 82 Snakeye 250-kg retarded bombs on the fuselage stations, two FFAR pods on the inboard wing pylons, two 272-kg (600-lb) BL755 cluster bombs on the centre wing stations, plus two AIM-9Ps and two PL-7s for self-defence.

The Q-5F prototype with two LS-500J laser-guided bombs under the wings.

This view of the Q-5F shows the ventral fairings associated with the targeting system.

Two prototypes were converted from Q-5 IIs; the first aircraft flew on 30th August 1988 but crashed on 17th October in that same year. The second prototype (marked A5M) flew on 8th March 1989, and a third aircraft was converted later to make up for the loss of the first one. On 19th February 1991 it was announced that development had been completed and an agreement was being negotiated to begin production; a Martin-Baker ejection seat and an Italian ECM pod were added in 1992. However, the A-5M did not attract any orders and the project was cancelled.

Q-5D ELINT aircraft

Confusingly, the designated Q-5D has also been reported for an electronic intelligence version of the Q-5 II (*Dian* – EW version). No details are known.

Q-5 refuelling system testbed

In an attempt to increase the Q-5's combat radius, Nanchang approached the British company Flight Refuelling Ltd. with a request to equip the aircraft with a probe-and-drogue IFR system. The probe-equipped Q-5 would work with the Xian HY-6 (H-6U) tanker. The system was built and tested but not introduced on operational *Fantans*.

Q-5 radar testbed

Late in its flying career the Q-5 II prototype ('10769 Red') was apparently converted into an avionics testbed with a fire control radar in a perfectly conical radome. The aircraft is currently on display at the PLAAF Museum in Xiaotangshan.

Shenyang JH-8 fighter-bomber (project)

In the early 1970s the Chinese military formulated a requirement for a new-generation strike aircraft to replace the obsolescent Q-5. The need for such an aircraft came about as a result of the crisis around the Xisha (Paracel) Islands, in which China clashed with Vietnam in January 1974. Despite the military victory scored by China, it was obvious that the Chinese marines seizing the islands were left without close air support – the Q-5 lacked the range, while the H-5 and H-6 bombers were too slow and ponderous.

A Q-5E in service with the 5th Division/13th Regiment. Note the undernose sensor fairing.

The idea was first voiced at a military planning conference in 1975. It took a while to agree the future aircraft's parameters; the PLAAF wanted an aircraft that would combine the range and payload of the H-5 and H-6 with the supersonic performance of the Q-5, while the PLANAF wanted the machine to carry four anti-shipping missiles while having at least three times the payload of the Q-5.

The general operational requirement arrived at eventually contained the following minimum figures: a payload of 3,000-5,000 kg (6,610-11,020 lb), a top speed of at least Mach 1.5, a ferry range of 2,800 km (1,740 miles) and a combat radius of 800 km (496

Close-up of an LS-500J laser-guided bomb carried by a Q-5.

The prototype of the Q-5J conversion trainer. The vertical stagger of the seats is clearly visible.

miles). Powerplants that came into consideration were the newly acquired Rolls-Royce RB.168 Spey Mk 202 afterburning turbofan with a maximum rating of 9,300 kgp (20,500 lbst) and the indigenous WS-6 afterburning turbofan rated at 7,260 kgp (16,000 lbst) dry and 12,430 kgp (27,400 lbst) reheat, which was then under development. The machine was to be a multi-role combat aircraft suitable for both Air Force and Navy operations – much like the European MRCA (the future Panavia Tornado).

The Shenyang Aircraft Co. was the first to respond, and very promptly, to the new requirement, offering a single-seater referred to in the western press as the JH-8 (*Jiangjiji Hongzhaji* – fighter-bomber); whether this aircraft really had an official designation is open to question. The aircraft was based on the J-8 heavy fighter, but not much was left of the original airframe. The JH-8 had new trapezoidal wings of reduced sweepback and a new forward fuselage – the nose intake gave place to a 'solid' nose and two-dimensional lateral air intakes with boundary layer splitter plates; the nose was drooped to maximise the downward field of view.

External stores were carried on six pylons under the wings and two pylons side by side under the centre fuselage; the outermost pylons were reserved for AAMs used for self-defence. The nose housed a targeting system. As distinct from the J-8 fighter, the JH-8 had a twin-wheel nose gear unit.

A three-view drawing published in the western press showed the JH-8 as being virtually identical to the projected Sukhoi T-58Sh strike aircraft – a radically redesigned Su-15TM interceptor (NATO reporting name *Flagon-F*). Development of the T-58Sh had begun in 1969; thus, there is a possibility that the Chinese intelligence service had succeeded in obtaining some information on that project.

A still unpainted Q-5J makes a test flight from the NAMC factory airfield.

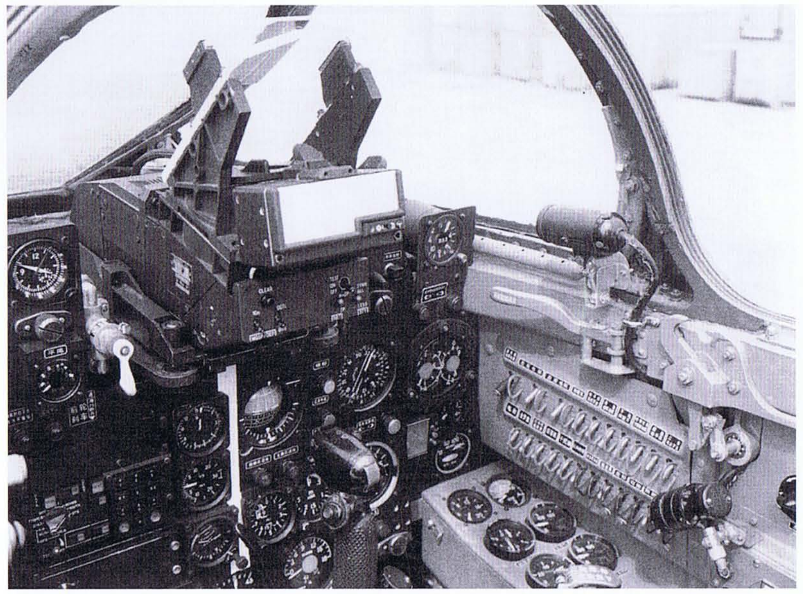
Wearing PLAAF insignia over the chrome yellow primer finish, the Q-5J shows its sideways-opening canopies. Note the NAMC K-8 Karakoram trainers in the background.

Basic specifications of the Q-5 (A-5)

	Q-5 III (A-5C)	A-5M	Q-5J
Length:			
less pitot	15.415 m (50 ft 6⅞ in)	15.366 m (50 ft 5 in)	17.11 m (56 ft 1½ in)
with pitot	16.255 m (53 ft 3 31/32 in)		
Wing span	9.7 m (31 ft 9⅞ in)	9.7 m (31 ft 9⅞ in)	9.7 m (31 ft 9⅞ in)
Height on ground	4.516 m (14 ft 9 51/64 in)	4.53 m (14 ft 10¾ in)	4.815 m (15 ft 9½ in)
Wing area, m^2 (sq ft)	27.95 (300.85)	27.95 (300.85)	27.95 (300.85)
Empty weight, kg (lb)	6,494 (14,317)	6,728 (14,833)	n.a.
MTOW, kg (lb):			
in 'clean' condition	9,530 (21,010)	9,769 (21,537)	n.a.
with max. external stores	12,000 (26,455)	12,200 (26,869)	n.a.
Fuel load, kg (lb):			
in 'clean' condition	2,883 (6,356)	n.a.	n.a.
with 400-litre (88 Imp gal) drop tanks	3,503 (7,723)		
with 760-litre (167.2 Imp gal) drop tanks	4,061 (8,953)		
Internal fuel capacity, litres (Imp gal)	3,720 (818.5)	n.a.	n.a.
Wing loading, kg/m^2 (lb/sq ft):			
in 'clean' condition	341 (69.9)	349.5 (71.58)	n.a.
with max. external stores	429 (87.9)	436.5 (89.4)	n.a.
Power loading, kg/kgp (lb/lbst):			
in 'clean' condition	1.47	1.3	n.a.
with maximum external stores	1.85	1.63	n.a.
Top speed in 'clean' condition, km/h (kts):			
at sea level	1,210 (654.05)	1,220 (659.45)	1,220 (758)
at 11,000 m (36,090 ft)	1,190 (643.24)	n.a.	
Unstick speed, km/h (kts):			
in 'clean' condition/15° flaps	300 (162)	n.a.	n.a.
with maximum external stores/25° flaps	330 (178)	n.a.	n.a.
Landing speed with brake parachute			
and 25° flaps, km/h (kts)	278-307 (150-165)	n.a.	n.a.
Take-off run, m (ft):			
in 'clean' condition/15° flaps	700- 750 (2,300- 2,460)	911 (2,989)	645 (2,120)
with max. external stores/25° flaps	1,250 (4,100)	1,250 (4,101)	
Landing run with brake parachute and 25° flaps, m (ft)	1,060 (3,480)		867 (2,845)
Rate of climb at 5,000 m (16,404 ft), m/sec (ft/min)	83-103 (16,340-20,275)	115 (22,638)	135 (26,575) †
Service ceiling, m (ft)	15,850 (52,001)	16,000 (52,493)	14,800 (48,560)
Range at 11,000 m at full military power			
w. maximum fuel, km (nm)*	2,000 (1,081)	2,000 (1,081)	1,617 (1,004)
Combat radius, km (nm):			
'hi-lo-hi' *	600 (324)	518 (280)	n.a.
'lo-lo-lo' (500 m; 1,640 ft)	400 (216)	322 (174)	n.a.
G limit:			
with maximum ordnance and full drop tanks	5.0	n.a.	+7.5
with empty drop tanks	6.5		n.a.
in 'clean' condition/15° flaps	7.5		n.a.

* 8,000/500/8,000 m (26,250/1,640/26,250 ft)
† at sea level

As compared to the J-8, the aircraft was to be powered by higher-rated engines (type not specified). Nevertheless, the JH-8's maximum speed dropped from Mach 2.0 to Mach 1.75 and the service ceiling from 20,000 m (65,620 ft) to 15,000 m (49,210 ft). On the other hand, the ordnance load was increased from the J-8's 2,200 kg (4,850 lb) to 4,500 kg (9,920 lb), with a maximum range of 3,000 km (1,863 miles).



The cockpit of the A-5K dominated by a head-up display.

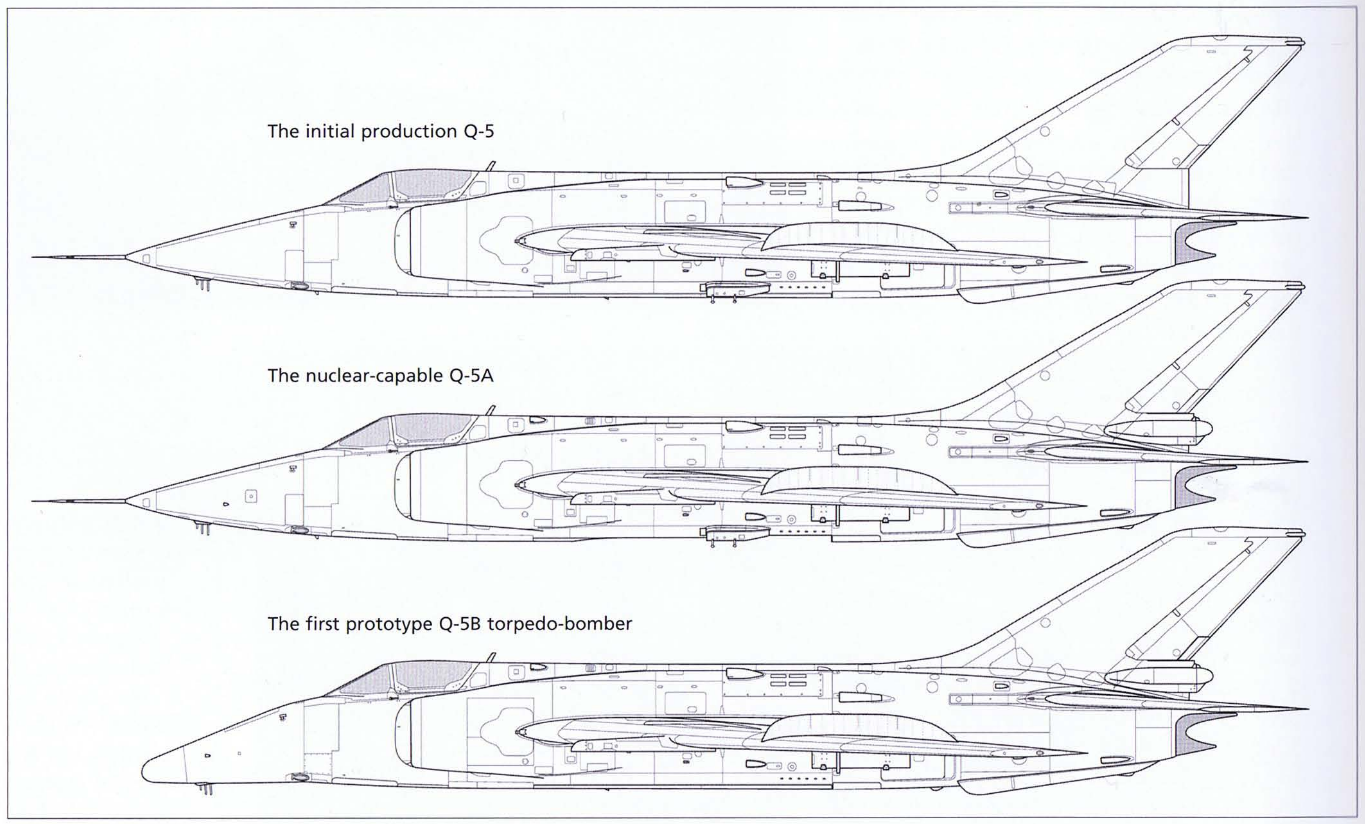
Apparently the project ran into serious problems because, in spite of the promising target performance, the government cancelled the programme in 1978. (Yet, three years later the JH-8 served as a basis for the J-8 II fighter.)

Nanchang Q-6 fighter-bomber (project)

The other Chinese aircraft manufacturer that was quick on the draw was the Nanchang Aircraft Manufacturing Co. – the manufacturer of the type to be replaced. The designers at NAMC chose a different approach. In the early/mid-1970s China had succeeded in obtaining two examples each of the Mikoyan MiG-23MS tactical fighter (NATO reporting name *Flogger-E*), MiG-23BN *Flogger-F* fighter-bomber and MiG-23UB *Flogger-C* combat trainer from Egypt. The MiG-23 was a single-engined fighter with shoulder-mounted variable-geometry wings and a conventional tail unit featuring stabilators, a large dorsal fin and a ventral fin that folded to starboard to ensure adequate ground clearance, deploying concurrently with landing gear retraction.

In addition to studying the *Flogger* carefully, NAMC designers visited several PLAAF and PLANAF units flying the Q-5 and talked to the pilots to find out what kind of aircraft they wanted. It took a while to integrate all the ideas, and the project of the new fighter-bomber designated Q-6 was not submitted for review to the Central Military Commission until February 1979.

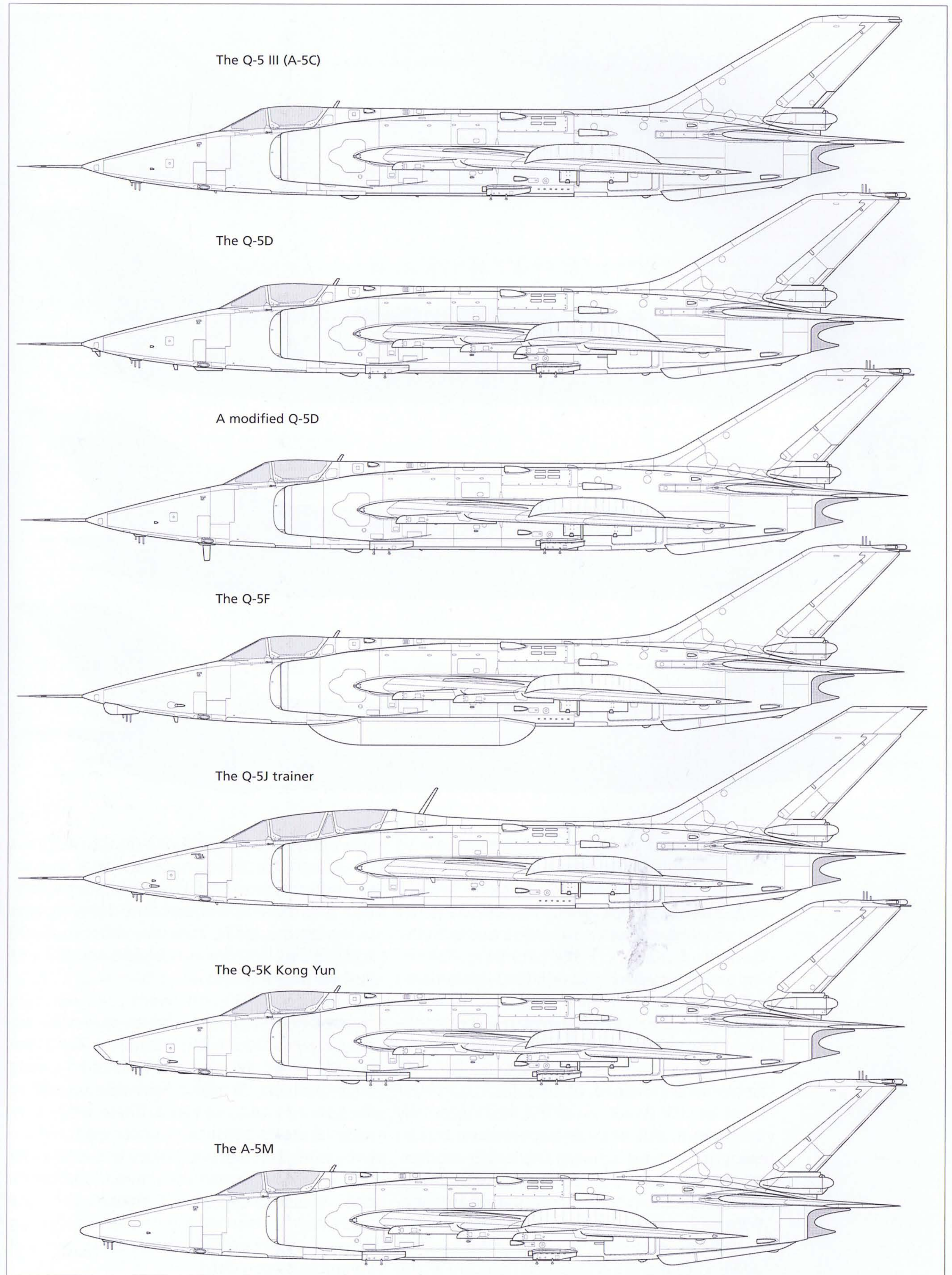
The Q-6 looked like a curious combination of two different aircraft from both sides of the 'Iron Curtain'. The centre/rear fuselage, wings and tail unit were borrowed wholesale from the MiG-23 (except that the tip of the fin was cropped horizontally, not raked). So were the main landing gear units featuring an ingenious



The initial production Q-5

The nuclear-capable Q-5A

The first prototype Q-5B torpedo-bomber



The Q-5 III (A-5C)

The Q-5D

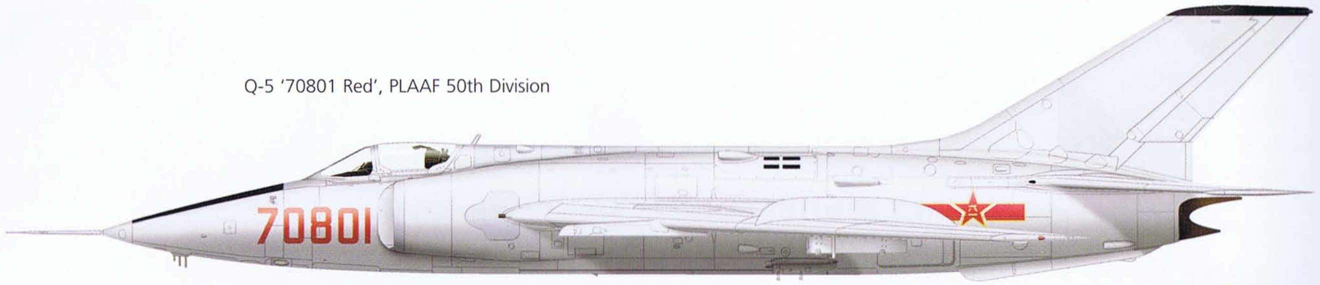
A modified Q-5D

The Q-5F

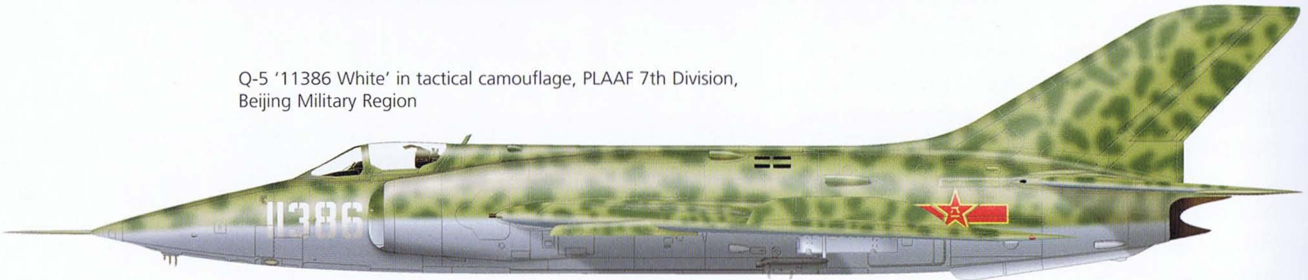
The Q-5J trainer

The Q-5K Kong Yun

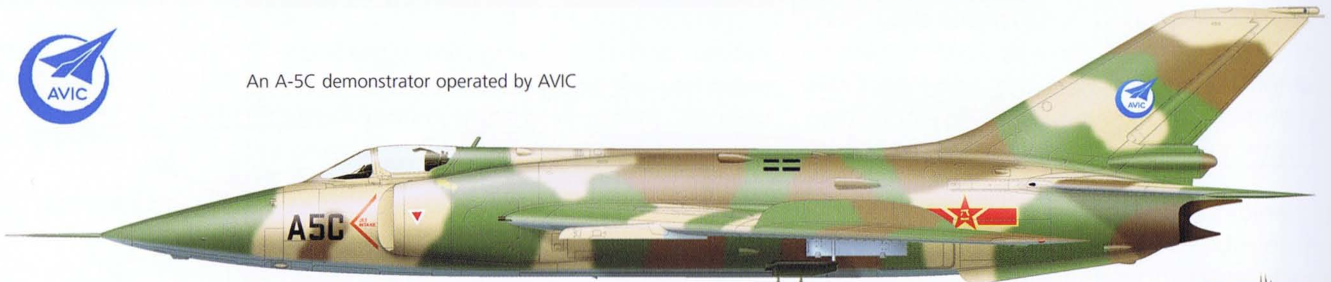
The A-5M



Q-5 '70801 Red', PLAAF 50th Division



Q-5 '11386 White' in tactical camouflage, PLAAF 7th Division, Beijing Military Region



An A-5C demonstrator operated by AVIC

Bangladesh Air Force A-5C 56910, 21 Sqn, Bashar (Kurmitola) AB, Dhaka

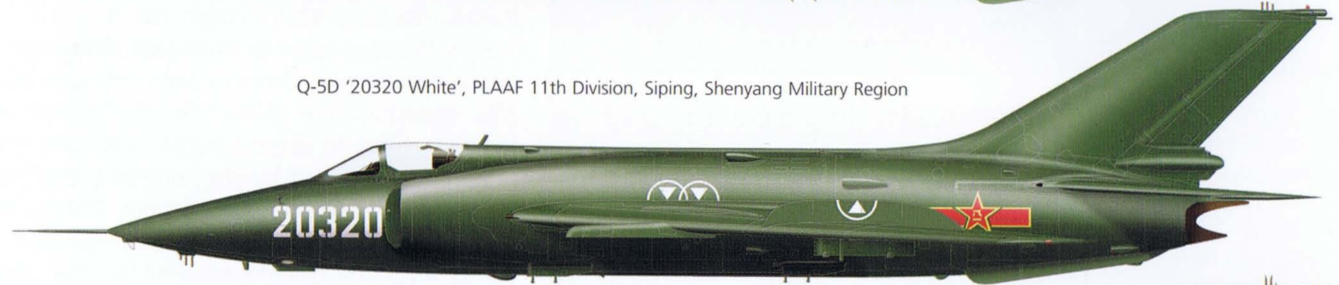
double-hinged design that allowed them to fold inward into a remarkably small space while leaving the fuselage centreline free for long external stores. The forward fuselage, on the other hand, bore a striking similarity to the General Dynamics F-16A Fighting Falcon: instead of two-dimensional lateral intakes with splitter plates the engine breathed through a single intake of quasi-elliptical section positioned below the single-seat cockpit. Similarly, the nose gear unit located further aft had a single wheel instead of two (it is not clear whether the wheel was to lie horizontally when retracted), and the large radome had an elliptical cross-section with the longer axis horizontal. Unlike the F-16, the cockpit canopy, though similar in shape, consisted of two sections with a fixed wraparound windshield.

Several powerplants were proposed. In addition to the WS-6 turbofan (selected as the No. 1 choice to power the Q-6), the designers considered the WS-9 turbofan or a reverse-engineered version of the Khachaturov R29-300 afterburning turbojet. The latter engine powering the MiG-23MS was rated at 8,300 kgp (18,300 lbst) dry and 12,500 kgp (27,563 lbst) in full afterburner.

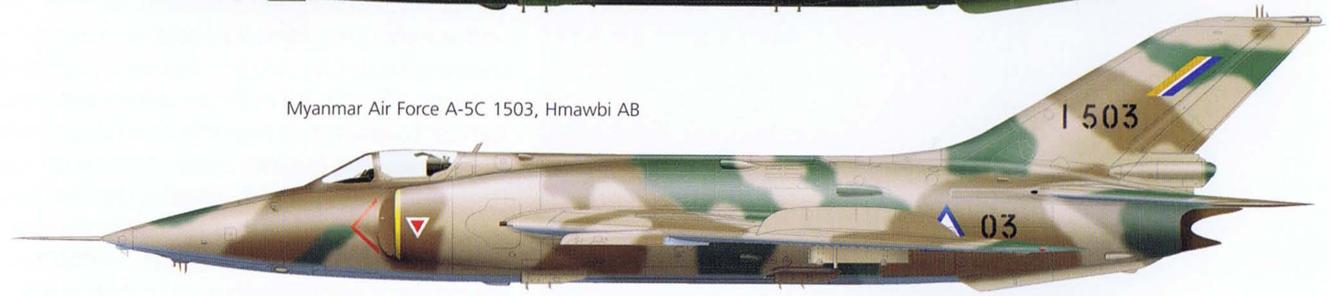
The Q-6 project underwent changes in the course of development. The latest version dispensed with the folding ventral fin but introduced a dogtooth on the stabilator leading edge, and the stabilator tips were parallel to the fuselage axis, not raked. There were three external stores hardpoints under each wing – two under the fixed wing glove and one under the outer wing panel; the inboard and centre ones could carry tandem stores, while the outer wing pylons were plumbed for carrying drop tanks (albeit possibly with the wings at minimum sweep only).

A Q-5 I with formation-keeping markings used for display flights

Pakistan Air Force A-5C 3W-124, 32 Wing/No. 7 Sqn 'Bandits', Masroor AB



Q-5D '20320 White', PLAAF 11th Division, Siping, Shenyang Military Region



Myanmar Air Force A-5C 1503, Hmawbi AB

The aircraft was to feature very advanced avionics by the day's standards, including a powerful navigation/attack radar with a terrain-following feature and an electronic flight instrumentation system. The weapons were to include laser-guided bombs of up to 500 kg (1,102 lb) aimed by means of a laser designator pod.

However, once again the designers encountered major development problems with the Q-6. The efforts to develop a sufficiently reliable wing sweep change mechanism were unsuccessful, and an attempt to copy the Soviet original from the MiG-23 produced a unit that was some 12% overweight, with an attendant reduction in the aircraft's payload and range. Worse, the development of the WS-6 turbofan was extremely protracted (eventually the engine never reached production).

As if that weren't enough, the Chinese military altered the specific operational requirement, demanding an even greater payload and even longer range. Another new requirement was a better defensive capability (reflecting the fact that the Soviet Union had bolstered its anti-aircraft defences along the Chinese border).

According to some sources, by 1983 the original Q-6 project based on the MiG-23 had given place to what was in effect a new aircraft built around a new WS-6G engine delivering up to 14,100 kgp (31,090 lbst) in full afterburner. Yet eventually the Chinese military cancelled the Q-6 in favour of the competing JH-7, which was based on more conventional technologies (see next entry) and offered less of a technical risk.

'083 Black', the second prototype JH-7 operated by the China Flight Test Establishment.

Here '083 Black' is seen during a demo flight at Airshow China 2002, where it figured as the FBC-1 Flying Leopard.

Xian JH-7 (FBC-1 Flying Leopard) fighter-bomber

The third contender in the race for a successor to the Q-5 was the Xian Aircraft Co., which took rather longer to prepare a proposal, submitting it in November 1977. As distinct from SAC and NAMC, the designers opted from the outset for a larger, two-seat aircraft in the same league as the General Dynamics F-111 Aardvark, the Sukhoi Su-24 (NATO reporting name *Fencer*) and, to a certain extent, the Panavia Tornado IDS (Tornado GR.1).

The development work proceeded in close co-operation with the Research Institute No. 603 (now XADRI). However, the designers found it hard to reconcile the very different requirements posed by the Air Force and the Navy. The PLAAF demanded an F-111/Su-24 look-alike (that is, with variable-geometry wings and side-by-side seating for the pilot and weapons systems operator for better co-ordination during night missions) optimised for low-altitude air defence penetration with terrain following, while the PLANAF wanted an aircraft with tandem seats and simpler conventional wings. Hence initially the Air Force version was regarded as a tactical bomber and designated H-7, while the Navy version was viewed as a fighter-bomber and referred to as the JH-7.

By the early 1980s, after three years of intensive research, the designers still had not reached a solution that would suit both 'customers'. The aircraft's powerplant was likewise undefined. Hence the MoD gradually began to downgrade the importance of the programme and could have cancelled it eventually, had not the Falklands War broken out in 1982. The Chinese military were so impressed by the actions of the Argentinean Navy's Dassault Super Etendard strike aircraft armed with AM39 Exocet anti-shipping missiles against the Royal Navy that the naval lobby won the upper hand in the programme. From November 1982 onwards development of the naval JH-7 was accelerated, while the H-7 bomber was put on the back burner and eventually abandoned altogether.

Another lucky turn in the JH-7 programme came in early 1983 when the powerplant was finally chosen. Instead of the hitherto favoured WS-6 turbofan (which, as already mentioned, was hampered by insurmountable development problems) XAC selected the WS-9 – a licence-built version of the Rolls-Royce RB.168 Spey Mk 202. Fifty of these engines (the version powering the McDonnell Douglas F-4K and F-4M Phantom II operated by the Royal Air Force and the Royal Navy respectively) had been delivered to China back in 1975 and a licensing agreement with Rolls-Royce had been signed the following year. The choice of the WS-9 over the WS-6 was reportedly influenced by the fact that the MoD had assigned huge funds for the reconstruction of the Xian aircraft factory and the co-located engine plant which were to produce the JH-7 and the WS-9 respectively.

Thus, in the early 1980s the design was frozen and the detail stage began. The JH-7 was a fairly large aircraft looking like a blend of the SEPECAT Jaguar and the Panavia Tornado IDS but being rather larger than either of them. Like the former type, it had shoulder-mounted moderately swept conventional wings and two-dimensional lateral air intakes with vertical airflow control ramps, boundary layer splitter plates and anti-surge doors. The wings had a kinked leading edge, wing sweep at quarter-chord being 55° inboard and 45° outboard. Like the Jaguar, there was a leading-edge dogtooth and a single boundary layer fence on each wing.

The forward and rear fuselage, on the other hand, were more like those of the Tornado – there was a large circular-section ogival radome and the crew sat in tandem under a common canopy on HTY-4 zero-zero ejection seats. Unlike the Tornado, which had

In a head-on view, the JH-7 looks rather like the SEPECAT Jaguar, except for the radome.

The JH-7 has seven hardpoints plus a built-in cannon to starboard. Here '083 Black' is seen with PL-2 AAMs and YJ-8 anti-shipping missiles.

JH-7 '084 Black', the third prototype, seen during tests.

JH-7A '813 Red' 'cleans up' after take-off with two LS-500J 'smart bombs' under the wings. Note the twin ventral fins of this version.

a two-piece canopy, the JH-7 featured individual aft-hinged sections for the pilot and the WSO with a fixed portion in between; the windshield incorporated a bulletproof windscreen. The engines were located well aft so that their nozzles were at the aft extremity of the fuselage, not ahead of the tail unit as on the Jaguar. The rear fuselage incorporated four airbrake panels.

The tail unit was basically similar to that of the Tornado, the stabilators being mounted rather low. However, the vertical tail appeared a bit too small for the aircraft's size and was augmented by a large ventral fin. The twin-wheel main landing gear units were definitely 'Jaguaresque', featuring a levered suspension and retracting forward so that the wheels lay horizontally beneath the inlet ducts. The nose unit was unlike either of the western types, having twin wheels and retracting aft. The wheel brakes were augmented by a brake parachute housed at the base of the rudder.

A notable feature of the JH-7 was its KF-1 fly-by-wire control system. As mentioned earlier, it had been verified on a specially modified JJ-6 trainer designated BW-1.

The JH-7 had seven external stores hardpoints, including two wingtip launch rails for PL-5B short-range AAMs. The aircraft was to carry the up to four of the new YJ-8 (C-801) ASMs developed by the China Haiying Electromechanical Technology Academy (CHETA). Alternatively, up to 20 250-kg (551-lb) bombs could be carried. Additionally, the aircraft had a 23-mm Type 23-III twin-barrel cannon (a copy of the GSh-23L) with 200 rounds mounted low on the starboard side of the centre fuselage.

The fire control system was built around a Type 232H 'Eagle Eye' pulse-Doppler fire control radar. Both the radar and the ASM had been put through their paces on the H-5 Ying testbed. The front cockpit featured an HK-13-03G HUD and three multi-function displays (two monochrome and one colour). Other avionics included a Type 8145 air data computer, an HG-563GB INS/GPS navigation system, a Type 210 Doppler navigation system, an HZX-1B autostabilisation system; the ECM suite comprised a Type 960-2 active jammer and a Type 914-4G chaff/flare dispenser.

In an unprecedented display of openness when it came to new military hardware, a model of the JH-7 to 1:100th scale was displayed at the 1988 Beijing International Defence Exhibition and at the Farnborough

An unmarked production JH-7 laden with a full ordnance load.

International '88 airshow. Both events took place before the aircraft had even flown. To the outside world the JH-7 was presented under the export designation FBC-1 (Fighter-Bomber, China, Type 1); it also had a marketing name, Flying Leopard (or Feibao in Chinese).

Once the design had been frozen, XAC was commissioned to build five flying prototypes and a static test airframe. Serialled '081 Black', the first prototype JH-7 made its maiden flight on 14th December 1988. It was soon followed by '083 Black', '084 Black', '085 Black' and '810 Red'; the would-be '082' was the static test article.

Due to the teething troubles of the licence-built WS-9 turbofan the prototypes and pre-production JH-7s were powered by original British-made Spey engines. The number of pre-production aircraft manufactured by 1992 was variously reported as 12 or 18.

The test programme lasted ten years. Few details are known due to the tight security that surrounded the programme; suffice it to say that no photos of the actual aircraft appeared in the world aviation press until late 1996. On 17th November 1989 the JH-7 broke the sound barrier for the first time. In 1995 or 1996 the fourth prototype crashed after a catastrophic engine failure, killing both crew members. Live weapons tests with the YJ-8 ASM did not commence until late 1996 – despite the fact that the missile had been first launched from the abovementioned H-5 Ying testbed as early as 25th May 1987.

In 1994, upon completion of the first phase of testing, the JH-7 achieved initial operational capability when several pre-production aircraft entered service with the 16th Regiment of the PLANAF's 6th Attack Division. Full-scale production was delayed by the ongoing problems with the WS-9 engines, and in 1997-98 the Liming Aero Engine Co. had to renew its ties with Rolls-Royce, enlisting the services of the British company in order to resolve these problems. In the meantime, XAC repeatedly considered replacing the WS-9 with the Russian Lyul'ka AL-31F afterburning turbofan or the

A brand-new JH-7 in primer finish makes a pre-delivery test flight at Xian.

Lower view of '81864 Red', a production JH-7 in PLANAF service. Note the built-in cannon.

A publicity shot of two JH-7As allegedly taking off; note the perforated airbrakes.

French SNECMA M53 afterburning turbofan (powering the Sukhoi Su-27/Su-30 family and the Dassault Mirage 2000 respectively). Eventually, however, it was decided to stick to the existing engine so as not to delay the programme further.

In 1998 the JH-7 finally received its type certificate. Yet the production problems with the powerplant continued for some time yet, so that deliveries of production aircraft to the PLANAF did not begin until 2001. As a result, the PLAAF dropped its plans to order the aircraft, opting for the Su-30MKK instead; the JH-7 was now a purely naval aircraft.

The type had its first 'public airing' back in 1995 when one of the prototypes appeared in a brief video sequence on Chinese TV – a report from a military exercise. In November 1998 the second prototype made a similarly brief appearance at Airshow China '98 as the FBC-1, taking part in the flying display. After that the type was assigned the NATO reporting name *Flounder*. On 1st October 1999 the JH-7 flew over Beijing, taking part in the parade on occasion of the People's Republic of China's 50th anniversary.

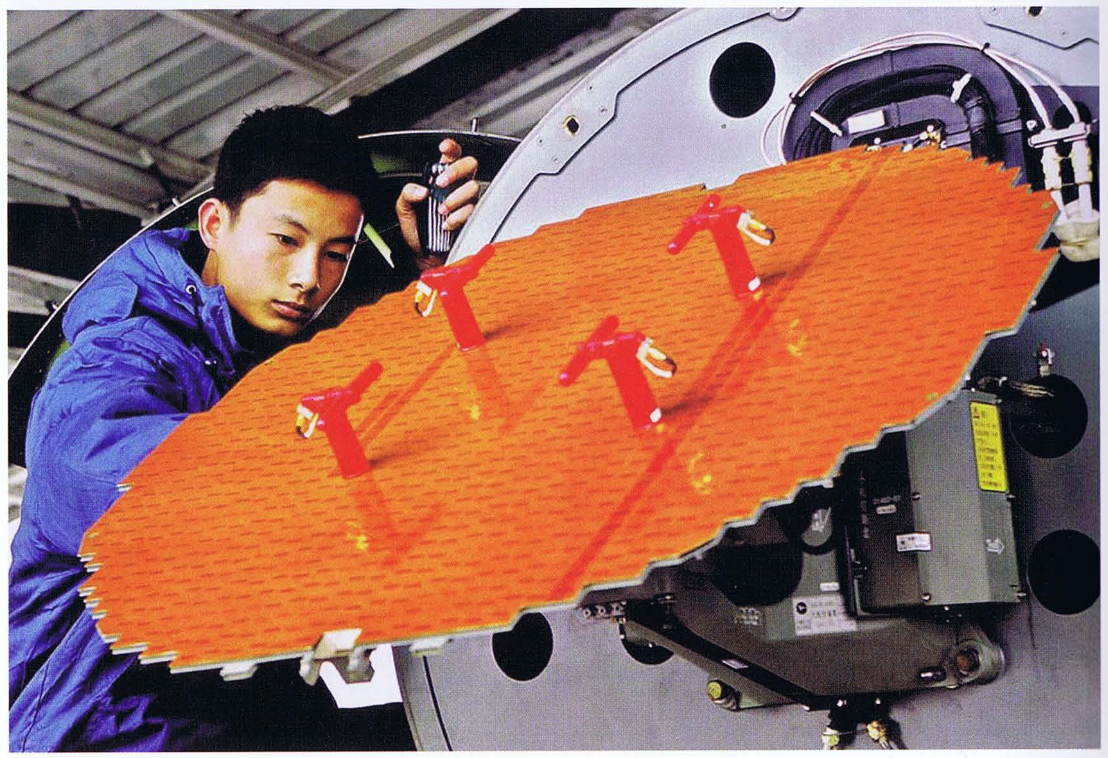
In December 1996 Iran considered the possibility of purchasing the FBC-1. North Korea and Pakistan were also named as potential customers. However, no export deals have been signed so far.

A YJ-8 on a dolly beside a JH-7A, with a second missile hooked up. Judging by the colours, these are test rounds.

JH-7A fighter-bomber

The second production version designated JH-7A (or JH-7 Block 02) differed from the initial model in having composite structures saving weight, an improved FBW control system and improved avionics. The latter included a new JL-10A Shan Ying J-band pulse-Doppler radar. The radar developed by the Laiyang Electronics Technology Research Institute (LETRI) had a detection range of 80 km (50 miles) and a tracking range of 40 km (25 miles) in look-up mode, or 54 km (34 miles) and 32 km (20 miles) respectively in look-down mode; the field of view in azimuth was ±60° and the radar could track four targets at a time.

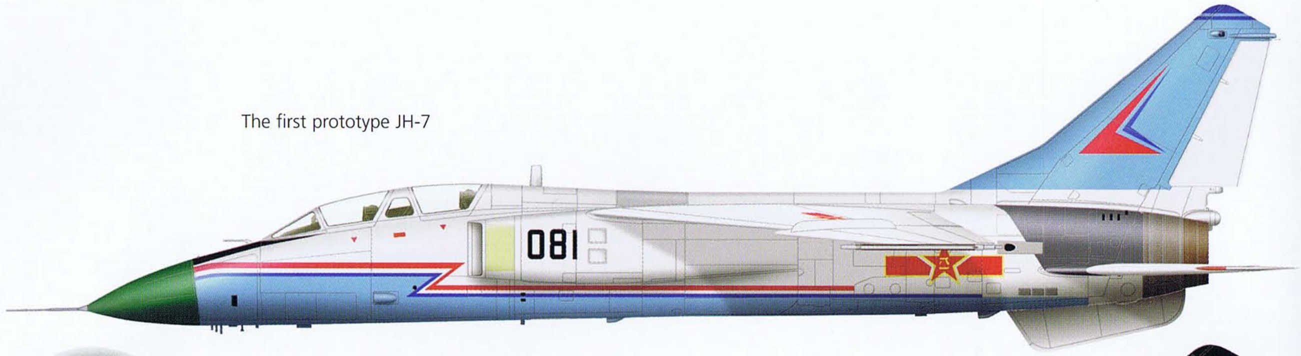
The number of wing pylons was increased from six to eight and two more hardpoints



The flat-plate scanner of the JL-10A Shan Ying fire control radar fitted to the JH-7A.

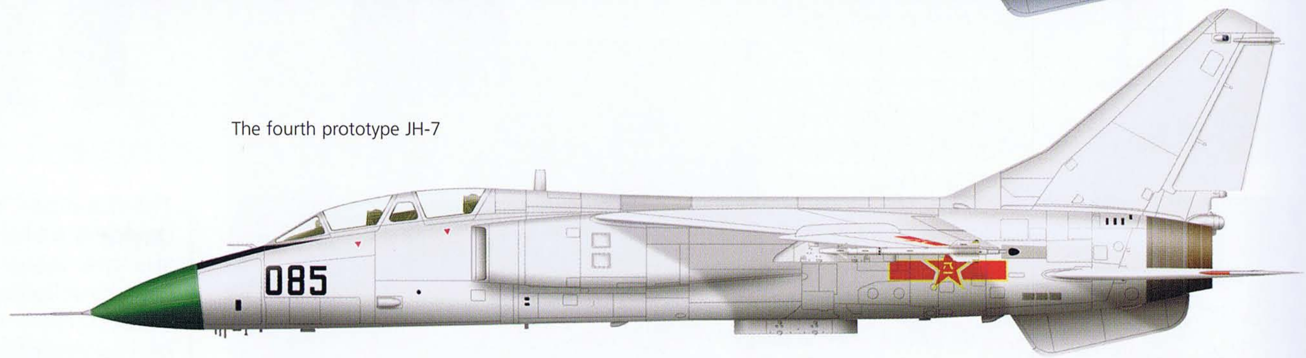
The flight line at Dachang AB near Shanghai occupied by at least a dozen 6th Division/16th Regiment JH-7s.

An operational JH-7 takes off. Note the formation keeping triangles on the fuselage spine and the wing fences.



The first prototype JH-7

The third prototype JH-7 and the badge reflecting the aircraft's marketing name Feibao (Flying Leopard)



The fourth prototype JH-7

were added under the air intake trunks; the latter hardpoints were reserved for mission equipment pods. The JH-7A could carry various free-fall and laser-guided bombs and YJ-81K or YJ-82K ASMs, as well as PL-5 or PL-7 AAMs. Russian Zvezda Kh-31P anti-radar missiles (known locally as YJ-91) could be carried for suppression of enemy air defence

Another view of Dachang AB, with life-vest clad airmen marching towards their JH-7s. Note the number of technicians beside each aircraft.

A production JH-7, PLANAF 6th Division/16th Regiment, Dachang AB

The JH-7A prototype

The JH-7A in demonstrator colours

(SEAD) mission The Russian laser-guided bombs were used in conjunction with a laser designator pod. Potential weapons included YJ-83 (radar-guided) and YJ-701 (TV-guided) ASMs. A new KG-8605 active jammer and KZ-8608 ELINT set was fitted. The maximum take-off weight was increased from 27,500 to 28,475 kg (from 60,630 to 62,776 lb) and the ordnance load from 5,000 to 6,500 kg (from 11,020 to 14,330 lb).

The first ten aircraft were delivered to XADRI for upgrading to JH-7A standard in September 2001. The new variant entered PLAAF service in 2004. Apart from the greater number of pylons, it could be identified by the one-piece windshield, the twin (but short) ventral fins and the lack of wing fences.

FBC-1M Flying Leopard II fighter-bomber

This is a proposed second export version featuring the same improvements as the JH-7A. No orders have been announced yet.

Specifications of the JH-7A

Length overall:	
less pitot	21.025 m (68 ft 11¾ in)
including pitot	22.325 m (73 ft 3 in)
Wing span	12.705 m (41 ft 8¼ in)
Height on ground	6.575 m (21 ft 6¾ in)
Stabilator span	7.39 m (24 ft 3 in)
Wheel track	3.06 m (10 ft 0¾ in)
Wheelbase	7.805 m (25 ft 7¼ in)
Wing area, m² (sq ft)	52.3 (563.0)
Take-off weight, kg (lb)	28,475 (62,776)
Maximum landing weight, kg (lb)	21,130 (46,580)
Maximum fuel load, kg (lb):	
internal	6,540 (14,420)
with drop tanks	10,050 (22,150)
Maximum ordnance load, kg (lb)	6,500 (14,330)
Ferry range, km (miles)	3,650 (2,270)
Combat radius, km (miles)	1,650 (1,030)
Service ceiling, m (ft)	16,000 (52,490)
Cruising speed	Mach 0.8-0.85
Maximum speed	Mach 1.7
Take-off run, m (ft)	920 (3,020)
Landing run, m (ft)	1,050 (3,440)

An atmospheric night shot of JH-7 '81765 Red', a 16th Regiment machine.

'21092 Yellow', a production JH-7A; note the one-piece windshield and the lack of wing fences. The machine belongs to the PLAAF 18th Division/ 52nd Regiment.

'30597 Yellow', another Air Force JH-7A flown by the 28th Division/ 82nd Regiment.

5 The Trainers

A production CJ-5 primary trainer in PLAAF markings.

Addressing the need to train pilots for the PLAAF and civil aviation alike, the Chinese aircraft industry took on the task of developing and producing trainers in several classes – primary, basic, advanced and conversion trainers. This chapter deals only with dedicated trainers developed as separate designs; the conversion trainers (dual-control versions of fighters and bombers) are not included, having been described in Chapters 2 and 3.

Once again, China started off by reproducing a Soviet design. In this case, however, the national aircraft industry moved on to independent development of trainers at a very early stage.

Nanchang CJ-5 primary trainer

The first trainer to be manufactured in China was the Yakovlev Yak-18 – the progenitor of the famous Soviet series of trainers and competition aerobatic aircraft. First flown in 1946, the Yak-18 *sans suffixe* was a low-wing monoplane with conventional tail surfaces and tandem cockpits enclosed by a common 'greenhouse' canopy with individual sliding sections. It had a fuselage truss made of chromansil steel tube, with hinged duralumin skin panels in the cockpit area, metal skin on the rear fuselage top and fabric covering elsewhere. The zero-dihedral rectangular wing centre section was all-metal but the tapered dihedral outer wings were fabric-covered with a metal framework; so were the strut/wire-braced tail surfaces. The aircraft had a tailwheel landing gear with aft-retracting main units and was powered by a 160-hp Shvetsov M-11FR five-cylinder radial driving a two-blade wooden propeller; the engine was enclosed by a distinctive helmeted cowling with individual fairings for the cylinders.

China obtained a licence to produce the Yak-18 *sans suffixe*, and the Nanchang

A PLAAF senior instructor gives last-minute instructions to a CJ-5 crew.

A technician turns over the engine of a CJ-5; a sister ship beyond is 'unbuttoned' for maintenance.

A pair of PLAAF CJ-5s in echelon port formation.

Begging for restoration, this anonymous CJ-5 sits in a remote corner of the PLAAF Museum.

Aircraft Factory (now Hongdu Aircraft Industry Group) was tasked with producing the trainer as the CJ-5 (*Chuji Jiaolianji* – primary trainer, Type 5). The original local designation was probably Hongzhuan-501 (Red Craftsman). According to the national aircraft industry's first five-year development plan the CJ-5 prototype was to be completed in September 1955. However, since the PLAAF was in urgent need of a primary trainer, the Chinese government reduced the development schedule by one year, deciding that the Nanchang Aircraft Factory was able to meet the new deadline. By then the factory had mastered the refurbishment of five aircraft types, including the Yak-18.

The task of setting up licence production was managed by the plant's chief engineer Li Shaoan and chief technologist Gao Yongshou, who received assistance from Soviet specialists. The prototype was delivered to the flight test facility on 30th June 1954, while the static test article had begun structural tests on 12th May. Incidentally, this was the first time destructive static testing had been carried out in China; engineer Zhang Azhou was responsible for this part of the programme.

The CJ-5 made its first flight on 3rd July 1954 at the hands of Duan Xianglu. The tests were rather brief; on 20th July the test commission decided that the aircraft met the performance target and cleared it for production. When production ended in 1958 the Nanchang Aircraft Factory had built a total of 379 CJ-5s, which were operated by the PLAAF, PLANAF and civil (CAAC) flying schools.

The aircraft was 8.072 m (26 ft 5 51/64 in) long and 3.1 m (10 ft 2 3/64 in) high in a tail-up position, with a wing span of 10.6 m (34 ft 9 21/64 in). It had a maximum take-off weight of 1,120 kg (2,470 lb), a maximum level speed of 248 km/h (154 mph) and a maximum range of 1,000 km (621 miles).

Nanchang CJ-6 (Hongzhuan 502) primary trainer

This CJ-5 also resides at the PLAAF Museum and is in much better shape.

The advent of aircraft featuring a tricycle landing gear created the need for a tricycle-gear primary trainer. Hence the Yakovlev Design Bureau brought out the Yak-18U which had a semi-retractable tricycle landing gear minimising the damage in the event of a belly landing. It was powered by the same M-11FR engine in a slightly modified cowling, but a new version followed soon – the Yak-18A, which had a new 260-hp Ivchenko AI-14R nine-cylinder radial driving a new propeller and enclosed by a new long-chord NACA cowling split into upper and lower halves.

'502 White', the Hongzhuan-502 prototype, after refit with an AI-14 radial. Note the oil cooler located below the cockpits.

The Yak-18A was duly studied by the design office of the Shenyang Aircraft Factory – and rejected as outdated. The reason was that the new model retained the basic airframe structure of the Yak-18 *sans suffixe* with a truss-type fuselage and fabric covering on most of the airframe. China, which was by then producing aluminium alloys in sufficient quantities, was in a position to build a more advanced design. Hence Xu Shunshou, the factory's chief designer, suggested developing an indigenous primary trainer. The design effort was led by Lin Jiahua and Cheng Bushi.

Originally designated Hongzhuan 502, the aircraft was superficially similar to the Yak-18A. The new trainer had an all-metal semi-monocoque fuselage, all-metal wings with a hint of 'inverted gull' layout and all-metal tail surfaces with cantilever stabilisers. The wings and tail surfaces were of trapezoidal planform, not rounded, and the fin featured a small root fillet. The canopy design was revised – the Hongzhuan 502 had a one-piece curved windshield improving the trainee's view and the rear section moved aft bodily, with no fixed portion aft of the instructor's seat. The landing gear was different, too – it was fully retractable, the main units retracting inward (not forward, as on the Yak-18A); the design was borrowed from the Aero C-11U (a Czechoslovak tricycle-gear version of the Yak-11 trainer). The powerplant was originally a Czechoslovak-built Praga flat-six air-cooled engine driving a two-blade propeller, also of Czechoslovak origin.

Brand-new CJ-6s awaiting delivery at Nanchang. The last aircraft in the row is a civil Haiyan version.

CJ-6As of the PLAAF 13th Flying Academy/1st Regiment at Bengbu. '71888 White' is unusual in having civil-style colours.

CJ-6As operated by the PLAAF 7th Flying Academy/1st Regiment at Changchun. This outfit has a non-standard serial system.

CJ-6A '87651 White' preserved in a rather psychedelic camouflage scheme.

A full-scale mock-up was built in May 1958; that same month it was decided to transfer the design work to the Nanchang Aircraft Factory, where a design office was established for this purpose. Gao Zhennning became the trainer's chief project engineer, with Tu Jida and Lin Jiahua as his deputies; the latter two were among the 20-plus Shenyang engineers sent to Nanchang to assist with the design process.

Appropriately serialled '502 White', the Hongzhuan 502 made its maiden flight on 27th August 1958 at the hands of Lu Maofan and He Yinxi.

CJ-6 primary trainer

An immediate problem arose: the wrong type of propeller had been chosen; the prop was not matched to the engine and could not absorb its full power, which meant the aircraft could not reach the design speed. In August 1959 chief project designer Ye Xulun proposed fitting the Hongzhuan 502 with an AI-14R engine in a NACA cowling driving a V530-D35 two-blade propeller with wide-chord wooden blades. A redesign was undertaken and the re-engined aircraft first flew on 18th July 1960 with Huang Zhaolian at the controls. In this guise the machine was soon redesignated CJ-6.

The new powerplant gave the CJ-6 a certain similarity to the Yak-18A. This is why the casual observer tended to regard it as a 'Yak-18A copy' – which it wasn't.

The trials included a special spin test programme – the first of the kind in China. For obvious reasons, safe spin recovery is all-important for a primary trainer; yet the CJ-6's spinning characteristics could not be explored beforehand because the requisite vertical wind tunnel was not available. Therefore the CJ-6 prototype was fitted with a spin recovery parachute; on 16th November 1960 project test pilot Huang Zhaolian made the actual test flights with positive results.

A pair of Sri Lanka Air Force PT-6A trainers.

In 1961 the Nanchang Aircraft Factory's design office made a few alterations to the design. The second prototype CJ-6 featured a revised engine cowling that kept the cylinder heads from overcooling and an oil cooler relocated from the original centreline fairing to the starboard wing root. Changes were made in order to eliminate unwanted yaw to the right, improve oil cooling efficiency and prevent asymmetric fuel consumption for the port and starboard wing tanks.

The second prototype completed its trials on 15th October 1961, having logged 612 hours in 1,800 flights. On 5th January 1962 the Military Products Certification Commission of China's State Council cleared the CJ-6 trainer for full-scale production. Early examples had Soviet-built engines and propellers, but in 1963 the AI-14R and the V530-D35 were successfully mastered in production as the Zhuzhou HA-6 and the Baoding J9-G1 respectively.

The CJ-6 came as a major boost to the PLAAF's training capability. The aircraft was rugged and easy to fly; it could operate from unpaved (dirt or grass) strips.

Many surplus CJ-6As were sold on the warbird market, gaining the most improbable colour schemes. This American example registered N82792 is one of them.

CJ-6A (PT-6A) primary trainer

An uprated version of the engine, the HS-6A delivering 285 hp for take-off, received its type certificate in December 1965. Hence the Nanchang Aircraft Factory started producing a version of the trainer powered by this engine and designated CJ-6A.

In 1979 the CJ-6A was awarded the Gold Quality Award of the state. By the time production ended in 1986 a total of 1,796 CJ-6s of all versions had been produced. The aircraft turned out to be a success on the world military market, seeing service with the air forces of Albania, Bangladesh, Cambodia, North Korea, Vietnam and Zambia. The export version was designated PT-6A (for Primary Trainer). In recent years the CJ-6A is also popular with private owners in the western world because of its 'warbird looks' and fighter-like handling.

A civil version of the CJ-6A designated Haiyan (Petrel) was also developed; it is described in the light aircraft section.

The CJ-6A was 8.46 m (27 ft 9 in) long and 3.25 m (10 ft 8 in) high, with a wing span of 10.18 m (33 ft 4¾ in). The empty weight was 1,172 kg (2,584 lb) and the maximum take-off weight was 1,419 kg (3,128 lb), including a 110-kg (243-lb) fuel load. The top speed was 287 km/h (178 mph), the service ceiling 5,080 m (16,665 ft) and the ferry range 640 km (398 miles). The take-off run and landing run were 280 m (920 ft) and 350 m (1,150 ft) respectively, and endurance was 3 hours 36 minutes. Some Chinese sources give slightly different figures: height on ground 2.94 m

Shenyang JJ-1 basic trainer

In order to assist PLAAF pilots in mastering jet fighters, in October 1956 the Shenyang Aircraft Factory's design department, which was then barely a month old, began development of a subsonic jet trainer designated Hongzhuan-503 but later renamed JJ-1. Actually the designation denoted that the aircraft was intended for fighter pilot training.

The still unserialled JJ-1 prototype; it subsequently became '101 Red'.

(9 ft 7¾ in), empty weight 1,095 kg (2,410 lb), MTOW 1,400 kg (3,090 lb), service ceiling 6,250 m (20,505 ft).

CJ-6B COIN aircraft

In 1964-66 the Nanchang Aircraft Factory converted ten standard trainers into counter-insurgency (COIN) light attack aircraft designated CJ-6B; they could carry various unguided weapons on wing pylons. The modification was not adopted for service.

Fact is, unlike the JJ-2, JJ-6 and JJ7 described in Chapter 2, the machine was not a derivative of an existing fighter.

The appearance of the JJ-1 could perhaps best be described as a cartoon version of the Lockheed T-33 Shooting Star. The fuselage had a parabolic nosecone and the cross-section changed from oval ahead of the cockpit to circular elsewhere. The tandem cockpits located ahead of the wings were enclosed by a common canopy featuring a sideways-hinged portion for the trainee and an aft-sliding portion for the instructor. In line with the cockpit windshield the fuselage was 'pinched' to make room for two elliptical engine air intakes (which were rather larger than the T-33's). The low-set wings were unswept, featuring a trapezoidal planform and slight dihedral; the conventional tail surfaces were likewise unswept, the trapezoidal fin featuring a small root fillet. The nose gear unit retracted forward, the main units inward into the wing roots.

Power was provided by a single non-afterburning centrifugal-flow turbojet whose type remains unknown. Some sources suggest this was a Soviet-supplied RD-500 (a copy of the Rolls-Royce Derwent V) delivering 1,590 kgp (3,505 lbst). The armament consisted of a single heavy machine-gun on the port side of the nose.

The first prototype JJ-1 ('101 Red') was rolled out amid great ceremony in July 1958, making its maiden flight on 26th July at the hands of Yu Zhenwu. At least one more flying prototype and obviously a static test airframe were also built.

The manufacturer's tests, which took place in July-October 1958, showed that the aircraft generally met the performance target. However, the JJ-1 had been conceived as an intermediate step between a piston-engined primary trainer and the Shenyang JJ-2 (UTI MiG-15, see Chapter 2). Later the PLAAF command decided to streamline the training process by eliminating this intermediate step and cancelled the JJ-1 programme. Nevertheless, the JJ-1 gave the Chinese aircraft industry the valuable experience of designing the first indigenous jet.

The JJ-1 prototype is now on display at the PLAAF Museum in this fictional colour scheme.

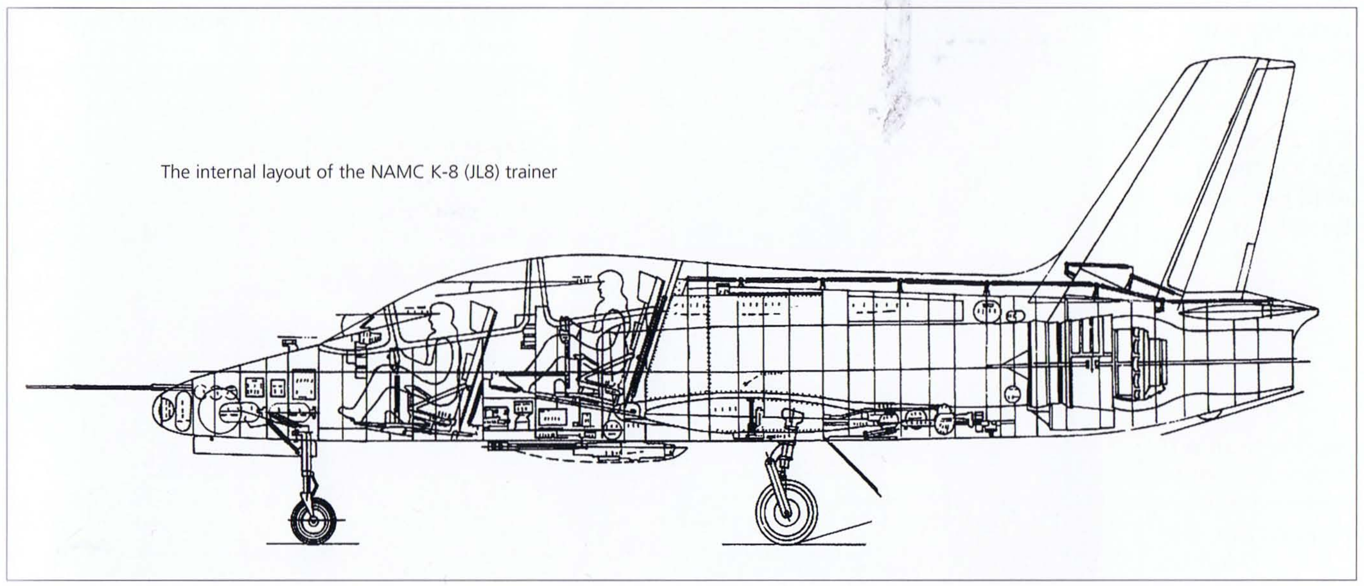
The fourth prototype K-8 advanced trainer with drop tanks; note the Chinese and Pakistani flags on the tail.

The aircraft was quite small, having an overall length of 10.56 m (34 ft 7¾ in), a wing span of 11.43 m (37 ft 6 in) and a height of 3.94 m (12 ft 11 7/64 in). The maximum take-off weight was 4,602 kg (10,145 lb); the trainer reached a top speed of 840 km/h (521.95 mph) at 8,000 m (26,250 ft) and a range of 1,328 km (825 miles) without drop tanks.

Nanchang K-8 (JL-8) Karakorum advanced trainer

In May 1987 China and Pakistan inked a deal to co-develop and co-produce an advanced jet trainer/light combat aircraft intended mainly for export. Pakistan, which had been buying Chinese weapons since the early 1970s, joined the project because it needed a replacement for the Pakistan Air Force's Cessna T-37 trainers, which were running out of service life, and for the obsolescent Chengdu FT-5 trainers.

The Nanchang Aircraft Manufacturing Co. (NAMC) became the main contractor in the



The internal layout of the NAMC K-8 (JL8) trainer

The K-8 final assembly shop at Nanchang. The vertical tails are composite structures. Note the PLAAF insignia.

programme, which was announced for the world to hear at the 1987 Paris Air Show under the designation L-8. Initially the Pakistani work share in the programme was limited to 12% but later increased to 25%. The Pakistan Aeronautical Co. (PAC) at Kamra was responsible for manufacturing the rear fuselage and the tail unit.

Redesignated K-8 and named Karakorum after a mountain ridge separating the two countries, the aircraft shared the general arrangement of such trainers as the Czechoslovak Aero L-39 Albatros, the Spanish CASA C-101 Aviojet and the Romanian IAR-99 Soim (to which it bore a particularly strong resemblance). The trainee and the instructor sat in a vertically staggered tandem arrangement on Martin Baker Mk 10L zero-zero ejection seats under a common sideways-hinged canopy. The unswept trapezoidal wings were low-set and the conventional tail unit comprised a gently swept vertical tail with a large root fillet and unswept tailplanes; the fin and rudder were made of composites. The landing gear comprised a forward-retracting nose unit and main units retracting inward into the fuselage. The engine – a single Garrett AiResearch (now Honeywell) TFE731-2A non-afterburning turbofan rated at 1,633 kgp (3,600 lbst) – was housed in the rear fuselage, breathing through large air intakes above the wing roots.

Two or four pylons could be fitted under the wings for carrying various external stores, including 12-round pods with 57-mm FFARs, bombs of up to 250 kg (551 lb) calibre, and 250-litre (55 Imp gal) drop tanks. If necessary, a 23-mm cannon could be installed in a conformal pod beneath the cockpits. The aircraft was fitted with western avionics, including Bendix/King navigation and communications suites, a Rockwell Collins EFIS-86T flight instrumentation system, and an AlliedSignal environmental control system.

NAMC started design work in June 1987. Construction of the first prototype began in

K-8 '206 Black' a (c/n 320206) in AVIC demonstrator colours.

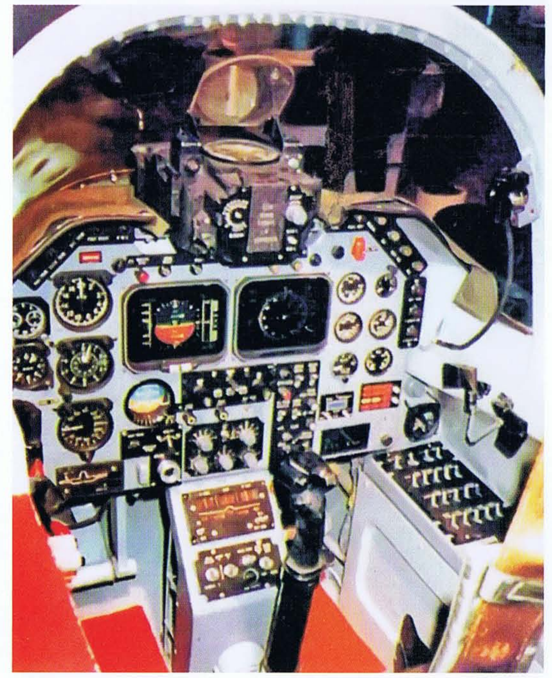
A considerable number of JL8s are in service with the PLAAF 13th Flying Academy/ 2nd Regiment at Bengbu.

1989; wearing its c/n (K8-001) as the serial, the machine made its maiden flight on 21st November 1990 with Ge Shun at the controls. The second prototype (K8-003) entered flight tests on 18th October 1991, followed by the third prototype (K8-004); the second airframe built was the static test article. All three prototypes wore the Chinese and Pakistani flags on the tail to underscore the programme's international status.

The first production example (1001, c/n 320101) was retained by NAMC as a demonstrator. On 9th April 1994 the PAF placed an initial order for six K-8s, which were formally accepted on 21st September and delivered to Pakistan on 10th November that year; the evaluation programme was completed in August 1995, the trainers subsequently entering service with the PAF Flight Academy at Risalpur. Another six were delivered to the PLAAF for evaluation. This was due in no small part to pressure from Pakistan which insisted that China should put the K-8 into PLAAF service and thus ensure continued production.

Apart from Pakistan (39 aircraft delivered), the K-8 has been exported to Ghana (four), Myanmar (12), Sri Lanka (six), Namibia (four), Zambia (eight) and Egypt (see K-8E below).

The aircraft was 11.6 m (38 ft 0¾ in) long, including the nose pitot, and 4.21 m (13 ft 9¾ in) high; the wing span was 9.63 m (31 ft 7¼ in) and the wing area was 17.02 m² (183.2 sq ft). The K-8 had an empty weight of 2,757 kg (6,078 lb) and a maximum TOW of 4,332 kg (9,550 lb) with external stores, including an internal fuel load of 780 kg (1,720 lb) and a maximum external stores load of 943 kg (2,080 lb). The aircraft could reach a top speed



The front cockpit of the K-8 featuring a two-screen EFIS and an optical sight.

'03-02-808', a K-8P, tailored to Pakistan Air Force requirements.

The first six K-8Ps awaiting delivery. All are fitted with conformal cannon packs.

of 800 km/h (496 mph) and a service ceiling of 13,600 m (44,620 ft), climbing at a maximum rate of 30 m/sec (5,900 ft/min). Range was 1,560 km (969 miles) on internal fuel only and 2,140 km (1,329 miles) with drop tanks; endurance was 3 hours 12 minutes and 4 hours 12 minutes respectively. The K-8 had a take-off run of 440 m (1,445 ft) and a landing run of 530 m (1,740 ft). The airframe was stressed for +7.33/–3Gs.

A batch of K-8s destined for Sudan. Note that the colour scheme is basically the same.

Five K-8M trainers awaiting delivery to the Myanmar Air Force.

K-8P advanced trainer

K-8P is the designation of the Pakistan Air Force version. It was also supplied to Ghana.

JL-8 advanced trainer

A wholly indigenous version of the K-8 designated JL-8 (*Jiaolianji* – trainer) was developed in parallel; its existence was caused by the need to get away from using imported components, which could be embargoed if Sino-Western relations became strained. (In fact, the USA did embargo the delivery of TFE731-2A engines, which had an impact on the K-8's production and delivery rate.)

As distinct from the standard version, the JL-8 had a Ukrainian-built ZMKB Progress (Ivchenko) AI-25TLK turbofan rated at 1,720 kgp (3,790 lbst) and an AI-9 auxiliary power unit for engine starting. The Martin-Baker ejection seats were replaced by indigenous Jianghan TY7 zero-zero ejection seats; apparently the avionics were likewise domestic ones. The weapons range included PL-7 short-range IR-homing AAMs.

Development was rather lengthy. The prototype (c/n JL8-202) took to the air in December 1994. The production version powered by the WS-11 turbofan (a reverse-engineered version of the AI-25TLK) was brought

A smartly painted Egyptian Air Force K-8E – the first example delivered.

A JL8 operated by one of the PLAAF Flying Academies

A Pakistan Air Force K-8P

A Sudanese Air Force K-8

AF-828, a Zambian Air Force K-8Z

Representatives of K-8 operators pose with a Ghanaian K-8P.

Two views of the K8V variable in-flight stability aircraft with FBW controls.

out in 1998. About 30 had been reportedly delivered to the PLAAF by late 1999, mostly serving with the No. 13 Flying Academy/2nd Regiment at Bengbu AB.

K-8E advanced trainer

A major boost for the K-8 programme came on 27th December 1999 when Egypt signed an order worth US$ 345 million for 80 K-8s intended as a replacement for the Egyptian Air Force's Aero L-29 Delfin trainers. According to the contract most of the aircraft would be manufactured in Egypt.

Designated K-8E (for Egyptian), the aircraft were tailored to EAF requirements. The cockpits featured new instrument panels and side control consoles; changes were made to the landing gear, the navigation and communications suites, the fuel system, the hydraulics, the fire control system and the environmental control system. The ventral cannon pod was fitted as standard.

The first two of the initial ten Chinese-built K-8Es were rolled out at Nanchang in late June 2001. The Arab Organisation for Industrialisation (the Egyptian contractor) then assembled two batches of 10 and 15 aircraft from Chinese-supplied CKD kits before progressing to 95% local manufacture of the remaining 45 machines.

K-8V control system testbed

The standard K-8/JL-8 had conventional mechanical flight controls. In 1997, however, the China Flight Test Establishment (CFTE) converted a single example into a testbed designated K-8V (c/n K8V-203 or 320203). The aircraft was fitted with a digital fly-by-wire (FBW) control system and side-stick controllers instead of normal control sticks. The control system could be reprogrammed to alter the aircraft's stability and handling, emulating other types of aircraft with differing control characteristics. The K-8V wore a gaudy red/yellow/blue/white colour scheme with CFTE titles and carried a large conformal pod with test equipment on the fuselage centreline.

Guizhou JL-9 (FTC-2000) Shan Ying combat trainer

A successor to the Guizhou JJ-7 conversion trainer was developed as a lead-in fighter

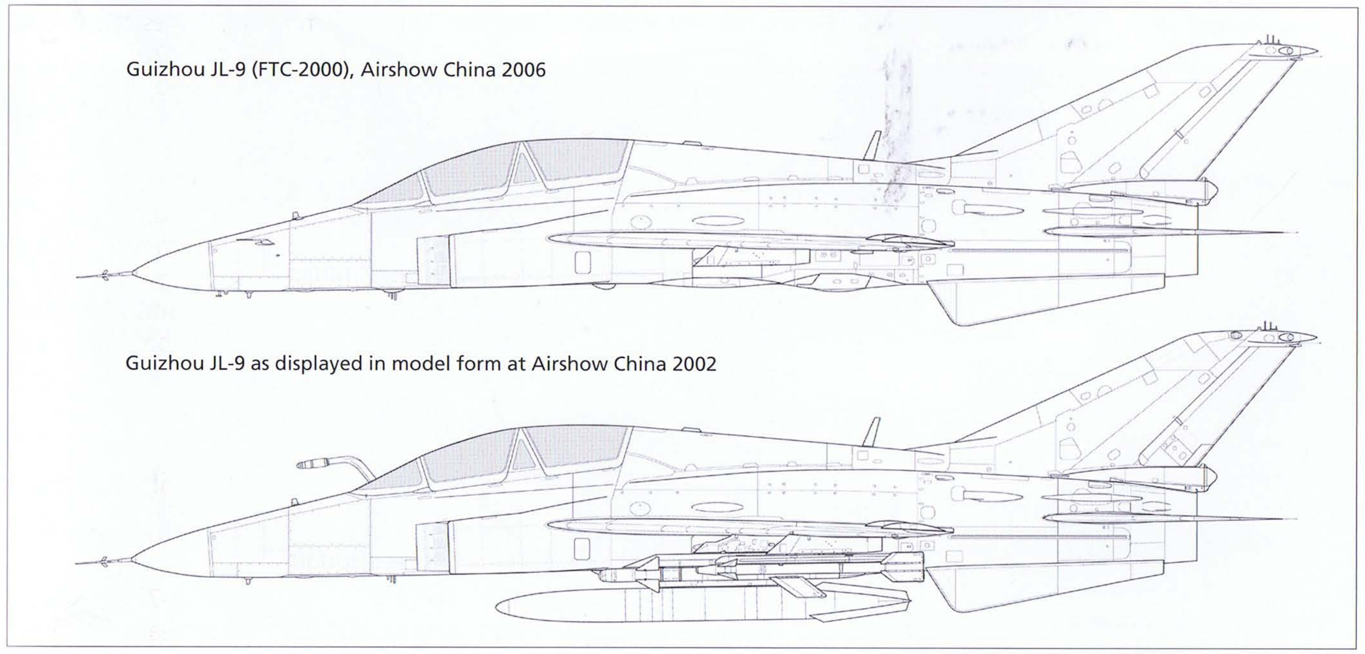
trainer for the Xian JH-7 (FBC-1 Flying Leopard) fighter-bomber and the Shenyang J-8D (F-8D) heavy fighter. While it was based on the airframe of the predecessor, the changes were extensive enough to warrant a new designation, JL-9 – or FTC-2000 for export. The aircraft also bore the popular name Shan Ying (Plateau Eagle).

The new trainer combined the centre/rear fuselage, tail unit and landing gear of the standard JJ-7 and the double-delta wings and powerplant of the J-7E/F-7MG with an all-new forward fuselage. Thus, by using proven technologies the Guizhou Aircraft Industry Group managed to keep down development costs and the unit price of the aircraft. This was important for the PLAAF, which had large numbers of JJ-6 and JJ-7 trainers badly in need of replacement.

The forward fuselage incorporated a small ogival radome which housed an Italian

A model of the JL-9 (FTC-2000) trainer shown at Airshow China 2002.

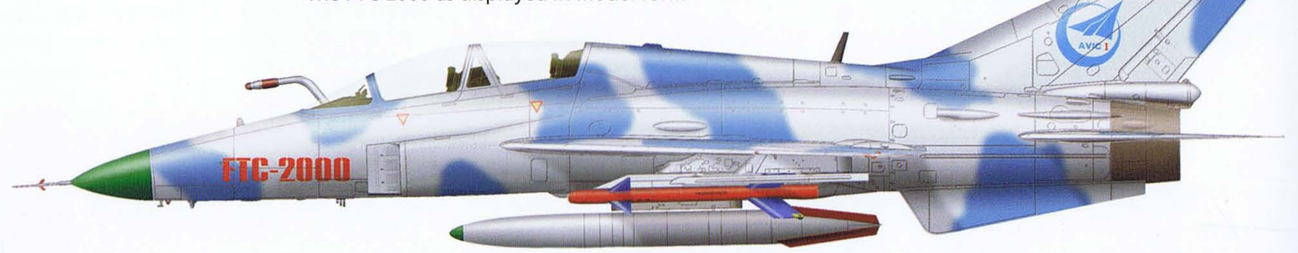
The unpainted JL-9 (FTC-2000) prototype during initial flight tests.



JL-9 (FTC-2000) and its 'Plateau Eagle' nose logo, Airshow China 2006, Zhuhai

The FTC-2000 as displayed in model form at Airshow China 2002

The FTC-2000 as displayed in model form



The first prototype JL-9, China Flight Test Establishment

The second prototype JL-9, CFTE

FIAR Grifo S-7 pulse-Doppler fire control radar (on the FTC-2000 export variant) or an indigenous fire control radar. The cockpits were staggered vertically and enclosed by a common canopy with a wraparound windshield and individual sideways-opening portions, with a fixed section in between; TY6D zero-zero ejection seats were installed. The JL-9 had an electronic flight instrumentation system with multi-function displays (MFDs); the front cockpit featured an XPS-2 head-up display. The avionics were integrated via a MIL-STD-1153B databus.

The JL-9 was powered by a WP-13F afterburning turbojet reportedly rated at 4,400 kgp (9,700 lbst) dry and 6,450 kgp (14,220 lbst) reheat. The engine breathed through semi-circular air intakes flanking the forward cockpit, with boundary layer splitter plates and auxiliary blow-in doors (the latter were located in line with the wing leading edge). A fixed L-shaped IFR probe similar to that of the J-8D was provided on the starboard side of the nose. There were four wing hardpoints and a centreline pylon; the inboard pylons were plumbed for carrying 480-litre (105.6 Imp gal) drop tanks, plus a third 480-litre or 720-litre (158.4 Imp gal) drop tank under the fuselage. The weapons options included PL-8 and PL-9 AAMs.

The JL-9 was revealed for the first time in model form at Airshow China 2000 at Zhuhai-Sanzao in November 2000. Two years later a full-scale mock-up converted from a JJ-7 airframe was on display at Airshow China 2002. The unmarked first prototype (c/n JL90001) made its first flight on 13th December 2003, followed by the second prototype four months later. A total of ten prototypes and pre-production aircraft took part in the manufacturer's and certification tests. In June 2005, Chinese media reported that the JL-9 programme has been listed in the PLAAF's 11th five-year procurement plan.

The aircraft has a normal take-off weight of 7,800 kg (17,200 lb) and a maximum take-off weight of 9,800 kg (21,610 lb), a top speed of Mach 1.6, a service ceiling of 16,000 m (52,490 ft) and a maximum climb rate of 260 m/sec (51,170 ft/min). The airframe is stressed for +8/–3Gs.

This view of JL-9 '421 Red' taxying out for a test sortie shows the large air intakes and their splitter plates.

The first ('421 Red') and second JL-9s seen during trials at CFTE.

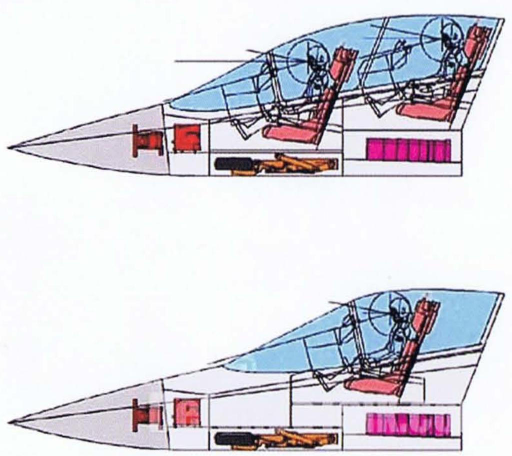
A pre-production FTC-2000 tucks up its landing gear.

A computer-generated image of the CY-1 combat trainer

A model of the two-seat CY-1 at Airshow China 2002.

CY-1 combat trainer/ LFC-16 fighter (project)

The Beijing SuperWing Technology Research Institute (*sic*) proposed a much-modified version of the JL-9 (FTC-2000), unveiling it in model form at Airshow China 2002. Designated CY-1 (Chao Yi), the aircraft had cropped-delta wings tipped with missile rails, shoulder-mounted cropped-delta canards and a taller, reshaped vertical tail with a raked tip. Additionally, the CY-1 featured 'side-plate canards' (*sic*) – rectangular lateral strakes beginning just aft of the canards' trailing edge and running all the way aft to merge with the horizontal tail, which had LERXes (!). By November 2004 a single-seat version designated LFC-16 (Light Fighter, China) had been added. GAIC was expected to build the aircraft if the decision to go ahead was taken.



The cockpit section layout of the L-15 and its proposed single-seat light strike version.

Hongdu L15 Hunting Eagle combat trainer

In 1999 the Nanchang-based Hongdu Aviation Industry Group (HAIG), which was vying with GAIC in the bid to deliver a lead-in fighter trainer comparable in aerodynamic performance and avionics to such fighters as the Sukhoi Su-27/Su-30 and Chengdu J-10, started work on the L15 advanced trainer. The first details of the programme were revealed in the form of a feasibility study in September 2001 at Aviation Expo 2001 in Beijing.

Unlike GAIC, which chose the 'keep it simple, but make it work' approach, the designers at Hongdu placed their bets on technological sophistication. The L15 was conceived as the Chinese answer to the South Korean KAI T-50 Golden Eagle, with broadly similar target performance figures – including a 1,500-km/h (931-mph) maximum speed – and a similar layout. A provisional display model seen at Airshow China 2002 showed shoulder-mounted moderately swept wings placed well aft and provided with huge scimitar-shaped LERXes. The mid-set sharply swept stabilators were positioned immediately aft of the vertical tail, which was also sharply swept and augmented by splayed ventral strakes. Two turbofan engines were placed side by side in the rear fuselage, breathing through boxy air intakes adhering to the underside of the LERXes; their nozzles jutted out beyond the stabilators and were separated by a 'pen nib' fairing. The pilots sat in tandem under a common canopy.

In 2002 HAIG signed an agreement with Yakovlev Aircraft, enlisting the help of the Russian airframer (which had a similar advanced trainer, the Yak-130, in the making) for the purpose of refining the L15. As a result, the aircraft underwent a substantial redesign – the proportions were markedly changed, the nose was made more pointed. To save time, the designers used certain features of the Yak-130; small wonder that the end result looked quite similar to the latter aircraft and its Italian 'cousin', the Aermacchi M346. The main external difference from these aircraft was that the engine housings still continued all the way to the aft extremity of the fuselage instead of terminating just aft of the wings.

The L15 featured such advanced technologies as a digital quadruple FBW control system, a 'glass cockpit' with three MFDs (plus an HUD) for the trainee and two for the instructor, and hands-on-throttle-and-stick (HOTAS) flight controls. The large LERXes and full-span leading-edge flaps provided for a maximum angle of attack of 30°, which was useful when simulating the manoeuvres of advanced fourth-generation fighters.

The L15 featured such advanced technologies as a digital quadruple FBW control system, a 'glass cockpit' with three MFDs (plus an HUD) for the trainee and two for the instructor, and hands-on-throttle-and-stick (HOTAS) flight controls. The large LERXes and full-span leading-edge flaps provided for a maximum angle of attack of 30°, which was useful when simulating the manoeuvres of advanced fourth-generation fighters.

The aircraft was powered by two afterburning turbofans giving it a high thrust/weight ratio and good manoeuvrability. The

The still-unpainted first prototype L15 on the ground and in flight.

The front cockpit of the L15 (in mock-up form) featuring two MFDs.

The L15 prototype, now in full colours as '01 Red', makes a demo flight.

猎鹰

The first prototype L15 as seen in 2007

engine type has been stated as the Ukrainian-built ZMKB Progress AI-222K-25F rated at 2,100 kgp (4,630 lbst) with afterburning, with the Czech-built Povazske Strojarne DV-2F as an alternative.

The wings featured six weapons hardpoints, a built-in cannon was provided and the nose theoretically enabled installation of a compact fire control radar, making the L15 suitable for conversion into a light fighter or light strike aircraft.

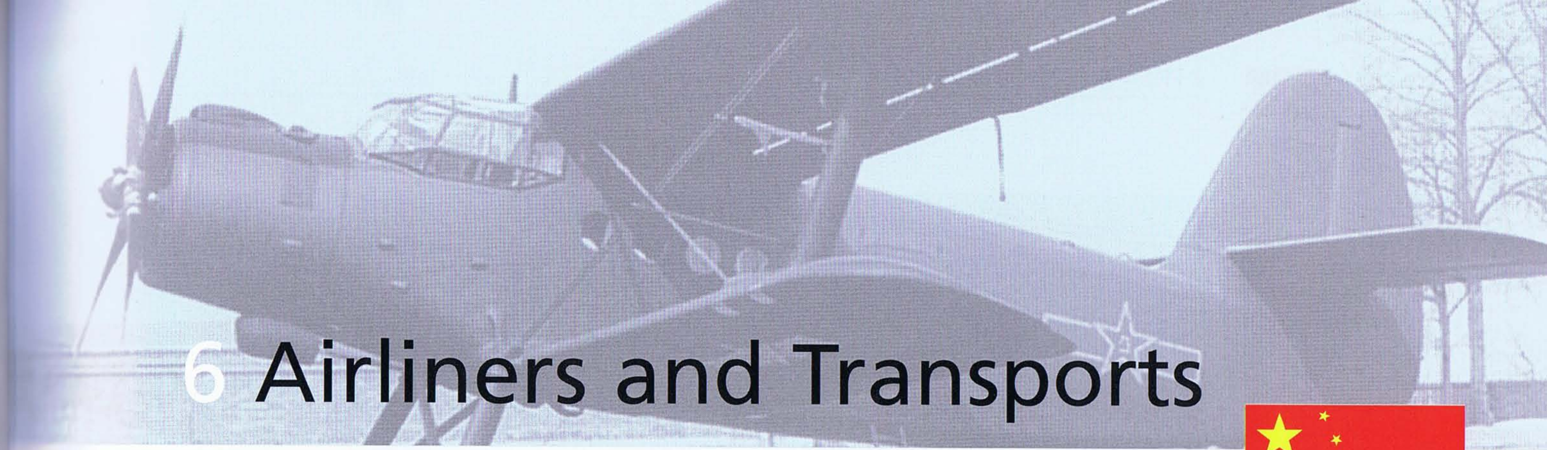
A full-size mock-up was unveiled at Airshow China 2004 in November, featuring wingtip launch rails for PL-8 AAMs. The first prototype ('01 Red') was rolled out on 23rd September 2005 and made its maiden flight on 13th March 2006 without the wingtip missile rails. The second prototype ('03 White') first flew on 10th May 2008. Currently Hongdu is actively promoting the L15 on both domestic and international markets. If the aircraft is chosen by the PLAAF, service entry could be as early as 2008-2010.

The L15 is 12.27 m (40 ft 3 in) long and 4.81 m (15 ft 9¼ in) high, with a wing span of 9.48 m (31 ft 1¼ in). It has a normal take-off weight of 6,800 kg (14,990 lb) and a maximum take-off weight of 9,800 kg (21,600 lb). The maximum speed is Mach 1.4; the service ceiling is 16,500 m (54,130 ft) and the maximum rate of climb is 150 m/sec (29,520 ft/min) at MTOW or 250 m/sec (49,200 ft/min) with 50% internal fuel. Ferry range is 3,100 km (1,926 miles). The airframe is stressed for +8/–3Gs.

Another view of '01 Red', showing the leading-edge flaps.

The second prototype L15, '03 White', differs in the design of the main gear doors.

This drawing shows the L15 carrying four laser-guided bombs and two PL-8 AAMs on wingtip launch rails.



6 Airliners and Transports

A Shijiazhuang Y-5, 8044 (c/n 1020), in CAAC colours at Wuhan.

The airliners and commercial/military transports that were produced (or were intended for production) in China are described here, along with their specialised derivatives. Since some aircraft (such as the Y-5) were built in both passenger and transport/utility configurations, splitting the chapter into airliner and transport sections has proved impossible. Therefore the aircraft are listed 'in order of appearance' of the baseline versions.

Nanchang/Shijiazhuang Y-5

In 1947 the Soviet aircraft design bureau headed by Oleg K. Antonov – now the Antonov Aviation Scientific & Technical Complex (ASTC) based in Kiev, the Ukraine – brought out the highly successful An-2 utility biplane (NATO reporting name *Colt*). This extremely versatile aircraft was supplied to a number of 'friendly nations', including the People's Republic of China, while it was still in production in the Soviet Union. In the mid-1950s China was in need of a go-anywhere light utility aircraft; the An-2 turned out to be an ideal candidate, and the Chinese government requested a manufacturing licence for the type. Thus China became the first foreign nation to build the An-2, receiving a set of manufacturing documents in October 1956. In January 1957 a group of Soviet specialists arrived to assist the local factories in mastering production of the airframe and the powerplant.

The State aircraft factory No. 320 in Nanchang (later called NAMC – Nanchang Aircraft Manufacturing Corp.; today the Hongdu Aircraft Industry Group) was the first Chinese manufacturer of the An-2. In accordance with the local aircraft designation system the An-2 was redesignated Y-5 (*Yunshuji* – transport aircraft, Type 5).

Smartly painted Y-5B B-8727 operated by the China Civil Aviation Flying College (CAFC).

The factory apron at Shijiazhuang with Y-5Bs destined for the CAFC and the PLAAF.

The 1,000-hp Shvetsov ASh-62IR nine-cylinder radial powering the An-2 was built under licence in Zhuzhou near Shanghai as the HS-5 (Huosai – piston engine) from 1956. (The Zhuzhou Engine Factory is now called SMPMC – South Motive Power & Machinery Co.) Early-production Y-5s were equipped with Polish-built AV-2 four-bladed propellers, but then the Chinese organised production of the AV-2 at Baoding under the designation J12-G15.

PLA paratroopers board a rather battered-looking PLAAF Y-5.

The first Chinese-built An-2 (c/n 0032001 – that is, Batch 00, factory No. 320, 01st aircraft in the batch) was completed in late 1957, making its maiden flight on 7th December. Full-scale production began in March 1958 but the pace was rather slow; only 727 (some sources say 728) examples had been completed when the Nanchang line closed in 1968. The last known Nanchang-built example is 8454 (c/n 1832038).

After that, Y-5 production was transferred to Harbin but in May 1970, before the Harbin factory had a chance to complete a single aircraft, production moved yet again to the Red Star Machinery Factory (plant No. 164) in Shijiazhuang. The factory (now called SAMC – Shijiazhuang Aircraft Manufacturing Corp.) turned out to be more successful as an An-2 manufacturer, rolling out the 1,000th Y-5 on 25th December 1996 – albeit this is not a very impressive rate either.

Shijiazhuang-built Y-5s originally had six-digit c/ns (for example, a Y-5 registered B-8032 is c/n 316405 – Batch 3, factory No. 164, 05th aircraft in the batch). In batches 4 and 5 the factory number was replaced by a code, 7055 (for example, B-8038 is c/n 4705517). From Batch 6 onwards the code was omitted; for example, B-8245 is c/n 0623 (Batch 06, 23rd aircraft).

Chinese versions of the An-2 are listed below.

This (supposedly) Y-5C at the PLAAF Museum is an ordinary landplane Y-5 with crudely attached Nanchang-built floats. The nose-up ground angle is absolutely unrealistic.

Y-5 light utility transport (Y-5N)

The Y-5 *sans suffixe* was the first production version – the Chinese equivalent of the An-2T. Some sources refer to the baseline version as the Y-5N.

Y-5 II agricultural aircraft

Originally called Fong Shou-2 (Harvester-2), the Y-5 II agricultural version was introduced in 1958. It was broadly equivalent to the Soviet-built An-2SKh and the Polish-built An-2R, featuring a chemical hopper in the cargo cabin and interchangeable crop-spraying and crop-dusting equipment. Certain design changes were introduced to make the cockpit acceptably cool in hot summer weather, allowing the aircraft to operate in the subtropical regions of southern China. The Nanchang factory built a total of 229 examples in Y-5 II configuration.

Y-5A feederliner

The Y-5A was the Chinese equivalent of the An-2P – an 11-seat passenger version for use on local air services by CAAC. It was brought out in 1959, and a total of 114 were built.

Y-5B light utility transport

Brought out in 1989, the Y-5B is an improved transport version with new avionics and a Polish-built ASh-62IR engine (designated PZL-Kalisz ASz-62IR) instead of the identically rated HS-5. 229 were reportedly built. The Y-5B had the same four-digit c/n system as used for late Y-5s *sans suffixe* but the batch number sequence started anew from 01.

A curious feature of the Y-5B are the optional cigar-shaped fairings extending aft from the tips of the upper wings and carrying triple winglets (known as 'tipsails'); the latter are set at different angles decreasing from front to rear (the rearmost pair is almost horizontal). If Chinese sources are to be believed, this modification increased rate of climb by 20% – from 3.2 m/sec (630 ft/min) to 3.75 m/sec (740 ft/min) – and improved the lift/drag ratio by 15%. 24 such aircraft have been built.

Oddly, some sources allege that Y-5B is the new designation of the Y-5 II agricultural version, but this must be an error.

Y5B-100 transport

This designation applied to a number of commercial Y-5Bs fitted with the 'tipsails'.

Specifications (Y-5B)	
Wingspan	18.19 m (59 ft 8 9/64 in)
Length overall (tail up)	12.75 m (41 ft 2 7/8 in)
Height on ground	4.1 m (13 ft 5 13/32 in)
Maximum take-off weight, kg (lb)	5,500 (12,125)
Maximum payload, kg (lb)	1,500 (3,310)
(8-10 armed soldiers)	
Maximum speed, km/h (mph)	256 (159)
Cruising speed, km/h (mph)	220 (136)
Range, km (miles):	
with maximum fuel	1,025 (637)
with maximum load	300 (186)
Service ceiling, m (ft)	4,500 (14,180)
Take-off run, m (ft)	153 (502)
Landing run, m (ft)	173 (567)
Crew	2-3

Y-5B (T) paradropping aircraft

A special version of the Y-5B developed for the PLAAF in 1995 is optimised for paradropping personnel, being the Chinese equivalent of the An-2TD. It differs in having updated avionics, including GPS. The aircraft can carry up to ten paratroopers.

Y-5B(K)

The designation Y-5B(K) has been quoted for an improved tourist variant of the Y-5B.

Y-5B(D)

Rather confusingly, this version has been reported as a 'tourist/agricultural variant'. It is

A brand-new Shijiazhuang Y-5B for the PLAAF with the optional 'tipsails'.

The Beijing-1 – the first airliner developed in China – preserved at its birthplace, the Beijing University of Aeronautics & Astronautics.

hard to imagine the same aircraft being used alternatively for dispensing chemicals and carrying passengers, with the latter suffering the effects of the former!

Some sources, however, present the situation the other way round, listing the Y-5B(K) as a passenger/transport variant and the Y-5B(D) as an agricultural version.

Y-5C seaplane (?)

Again, the Y-5C is the subject of a controversy. Some sources identify it as a seaplane version equipped with twin floats – the Chinese equivalent of the Soviet-built An-2V or the Polish-built An-2M (it is also called Qing-5). Only 11 were reportedly built for the PLANAF. The first five machines manufactured in 1964 had floats of the original Soviet design but in 1965 the Nanchang factory designed its own floats which were fitted to the other six examples.

Other sources, however, say the Y-5C is a landplane version fitted with the abovementioned triple winglets and featuring enhanced corrosion protection. The prototype reportedly entered flight test in 1996; this was followed by an initial order for 24 aircraft from the PLAAF.

Y-5D bomber trainer

In 1958 the Nanchang factory designed the Y-5D version intended for training the PLAAF's bomber pilots and navigators. The D suffix may stand for Dian, the Chinese designation for electronic warfare versions. The prototype first flew in 1962; a total of 116 examples were produced.

Y-5K VIP transport

A VIP version of the Y-5 was developed as the Y-5K. Several layouts existed; the first was a five-seater for the PLAAF developed in 1958. A seven-seat version was built in August 1960 for the Vietnamese leader Ho Chi Minh; two similarly configured Y-5Ks were delivered to the Royal Flight of Nepal in 1962-63 as gifts to King Birendra.

Y-5 turboprop conversion (project)

The Shijiazhuang Aircraft Co. is considering replacing the 1,000-hp Huosai-5 radial with a more powerful turboprop, thereby creating a Chinese counterpart of the An-3.

Beijing-1

In February 1958 the Beijing Aviation Institute – now the Beijing University of Aeronautics and Astronautics (BUAA) – began development of the first indigenous passenger aircraft. Aptly designated Beijing-1, the aircraft was created jointly by the institute's teachers, students and staff.

The machine resembled a cross-breed between the Soviet Yakovlev Yak-16 and the British de Havilland DH.104 Dove, being a twin-engined low-wing aircraft with an oval-section fuselage and conventional cantilever tail surfaces. Like the Dove, it featured a retractable tricycle undercarriage; the nose unit retracted aft but the main units retracted forward into the engine nacelles, not outward into the wings. Like the Yak-16, the aircraft was powered by radial engines with broad-chord NACA cowlings driving two-bladed propellers; the engines were apparently 260-hp Ivchenko AI-14 nine-cylinder radials imported from the Soviet Union.

The aircraft was quite small, being 12.15 m (39 ft $10\frac{11}{32}$ in) long and standing 4.39 m (14 ft $4\frac{53}{64}$ in) tall when parked, with a wing span

of 16.4 m (53 ft $9\frac{43}{64}$ in). The narrow cabin accommodated eight to ten passengers two-abreast. The maximum take-off weight was 3,000 kg (6,610 lb), including maximum payload of 1,219 kg (2,687 lb).

The design process, which was kicked off by a directive signed by Prime Minister Zhou En-lai, took less than a year. The Beijing-1 prototype performed its maiden flight at the capital's airport on 23rd September 1958 with Pan Guoding at the controls. The aircraft remained in prototype form.

Capital-1

Almost concurrently, the Capital Machinery Factory in Beijing developed a light transport/utility aircraft called Capital-1. One may justifiably call this aircraft the Chinese counterpart of the Antonov An-14 Pcholka (Little Bee) utility transport, as the general arrangement was almost identical and the two aircraft were similar in size. Like the An-14, the Capital-1 was intended for short-haul passenger and cargo transportation, forestry patrol, fishery patrol and survey.

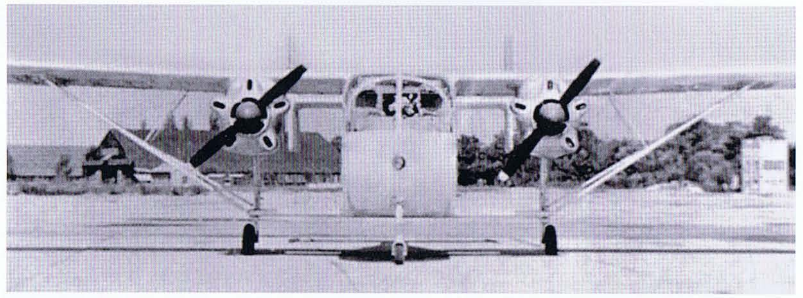
The aircraft was a high-wing monoplane with strut-braced wings and a blunt-nosed fuselage tapering off into a tailboom-like structure carrying a twin-fin tail unit. Two 160-hp Shvetsov M-11FR five-cylinder radials manufactured under licence by the Zhuzhou Engine Factory were installed in underslung nacelles, driving two-bladed variable-pitch wooden propellers with spinners; they were enclosed by helmeted cowlings similar to those of the Yakovlev Yak-12 utility aircraft and the Yak-18 trainer. A pair of rather large stub wings carried the lower ends of the V-shaped wing struts and the lower ends of the main gear struts whose upper ends were attached to the engine nacelles.

The aircraft was quite compact, being 9.502 m (31 ft $2\frac{3}{32}$ in) long and 3.955 m (12 ft $11\frac{45}{64}$ in) high when parked, with a wing span of 16.64 m (54 ft $7\frac{1}{8}$ in). The maximum take-off weight was 2,400 kg (5,290 lb), including a 870-kg (1,920-lb) payload equivalent to eight passengers travelling light or six passengers with 15 kg (33 lb) of baggage each.

The Capital-1 took to the air on 29th September 1958. Tests showed a maximum level speed of 185 km/h (114.95 mph) and a maximum range of 658 km (408 miles). The aircraft did not enter production.

Harbin Song Hua Jiang-1

Concurrently, the Harbin aircraft factory brought out the Song Hua Jiang-1 utility aircraft. It was basically a reverse-engineered design but, for once, the original was not a Soviet design but a Czechoslovak one – the Aero Ae 45S six-seat aircraft intended for use



Head-on view of the Capital-1 light transport.

as an air taxi. It was a low-wing monoplane of all-metal construction with cruciform tail surfaces and a tailwheel landing gear. The powerplant consisted of two 103-hp Walter Minor III air-cooled four-cylinder inverted inline engines driving two-bladed propellers. The main gear units retracted aft into the engine nacelles; the tailwheel was fixed. The main difference from the Czechoslovak aircraft lay in the extensively glazed cabin; it was extended forward to accommodate an extra (third) row of seats and the fuselage nose incorporated a stepped windscreen instead of a smoothly integrated one.

The Song Hua Jiang-1 likewise made its first flight on 29th September 1959. It was longer than the Ae 45S, measuring 8.58 m (28 ft $1\frac{53}{64}$ in) versus 7.54 m (24 ft $8\frac{27}{32}$ in), but the wing span was the same at 12.3 m (40 ft $4\frac{1}{4}$

The Song Hua Jiang-1 light passenger/utility aircraft.

in). The aircraft could carry six persons (one pilot and five passengers); if the passenger seats were removed it could carry small items of cargo or mail. The maximum take-off weight was 1,600 kg (3,527 lb), including a 640-kg (1,410-lb) payload; the aircraft reached a top speed of 274 km/h (170.25 mph) and a range of 805 km (500 miles).

The rather utilitarian-looking Jing Gang Shan-4 twin-turboprop transport.

Nanchang Jing Gang Shan-4

In 1970 the Nanchang aircraft factory developed another light transport aircraft bearing the name Jing Gang Shan-4. It resembled a scaled-down version of the Shorts SD3-60 airliner, having a slab-sided fuselage with a pointed nose, shoulder-mounted strut-braced wings and a conventional tail unit with a swept fin. Two turboprop engines were installed in cigar-shaped underslung nacelles, driving three-bladed variable-pitch wooden propellers with large spinners. However, the Jing Gang Shan-4 had dihedral tailplanes and a fixed landing gear; also, the fuselage incorporated a rear loading ramp akin to that of the similarly sized CASA C-212 Aviocar. The first flight took place on 30th September 1970.

The aircraft was 14 m (45 ft 11$\frac{3}{16}$ in) long and 5.37 m (17 ft 7$\frac{13}{32}$ in) high when parked, with a wing span of 19.5 m (63 ft 11$\frac{23}{32}$ in). The maximum take-off weight was 5,700 kg (12,570 lb), including a 1,800-kg (3,970-lb) payload; the machine attained a maximum speed of 337 km/h (209 mph) and a maximum range of 860 km (534 miles). Once again, the Jing Gang Shan-4 remained in prototype form.

Y6 airliner (project)

The designation Y6 was reserved for a Chinese version of the Il'yushin IL-14 airliner and transport (NATO reporting name *Crate*). Eventually, however, the plans to reverse-engineer the IL-14 were cancelled in favour of the more advanced An-24 turboprop (see below).

Xian Y7 family

Y7 airliner/transport

Despite the fact that Sino-Soviet relations were deteriorating, China had been importing the Antonov An-24 twin-turboprop airliner (NATO reporting name *Coke*) since the mid-1960s. As

B-3453, a China Eastern Airlines Y7, at Tianjin.

B-3499, the Y7-100 demonstrator (c/n 03702), shows off its distinctive winglets.

early as 1966 the Chinese government negotiated a licence to build the An-24T freighter and its powerplant. The intention was that the An-24, which would be manufactured in both cargo and passenger configurations, would replace the obsolete Lisunov Li-2 *Cab*, Il'yushin IL-12 *Coach* and IL-14 piston-engined aircraft in PLAAF service.

Prime Minister Zhou En-lai approved the design concept in October 1966. The task of copying the An-24 was assigned to a team composed of the Xian, Nanchang and Chengdu aircraft factories plus the Xian Aircraft Design & Research Institute (XADRI). The design team was headed by Li Xipu, the vice chief engineer of the Xian Aircraft Factory, with Xu Shunshou (Vice-Director of XADRI) as his assistant.

The first An-24T assembled in China took off on its maiden flight on 25th December 1970 at the hands of test pilot Li Ben-shung. The aircraft factory in Xian, the capital of Shensi (Shaanxi) Province, launched production of the type in 1977 while still building the H-6 bomber at the same time. The Chinese-built version was designated Y7, while the licence-built AI-24 turboprop became the WJ-5A.

The attempt to produce the An-24 came at a most inopportune time when China was in the throes of Mao Zedong's notorious Cultural Revolution. Many of China's leading aviation specialists, especially those who had had contacts with the Soviet Union (which was now in disfavour), were purged and sent to jail or executed. As a result, the Y7's production entry period dragged on for an incredible 13 years – probably a world record. This is partly because the aircraft failed its certification trials twice (in 1977 and 1979) due to being underpowered and had to wait until a more powerful version of the engine – the WJ-5A-1 – was available.

The WJ-5A entered production the Dong'an Engine Factory, while the AV-72 propeller of 3.9 m (12 ft 9½ in) diameter was produced as the Baoding J16-G10A.

A pre-production aircraft was unveiled to the general public at Nanyuan airbase near Beijing on 17th April 1982. The first production aircraft (identity unknown, c/n 01701 – ie, Batch 01, Y7, first aircraft in the batch) was not rolled out until 1983, entering flight test in February 1984. Actually the initial Chinese-built version conformed to the An-24B airliner, not the An-24T, featuring a full complement of windows and doors. The aircraft was subjected to extensive trials which involved flights in 28 provinces and included flights in 'hot-and-high' conditions and single-engine tests at Tianjin-

Y7-100 B-3445 operated by Sichuan Tri-Star General Aviation has been converted for geophysical survey by China Electronics Technology Corp. (CETC).

Zhangguizhuang airfield. A type certificate was finally awarded in 1982.

Y7 production picked up pace rather slowly. Most of the 20 initial production aircraft were delivered to the PLAAF; most of them were transports, though a few aircraft were built in 52-seat airline configuration at this early stage for delivery to the Chinese state airline CAAC (the Civil Aviation Administration of China).

Y7-100 airliner

The first version of the An-24 originating beyond the Great Wall was the Y7-100 developed in co-operation with the Hong Kong

Y7-100C B-3707 (c/n 12701) operated by Air Chang'an Airlines.

Aircraft Engineering Co. (HAECO) in 1984 to meet British Civil Airworthiness Regulations (BCAR) standards. (Hong Kong, as the reader remembers, was then an independent entity, read: an island of capitalism in Communist China.) Outwardly it differed from the standard early-production Y7 (An-24RV) mainly in having small winglets. These were supposed to reduce drag in cruise flight by 4%, giving a 5% reduction in fuel burn – a claim which later proved to be somewhat exaggerated. The aircraft also featured a flight deck configured for three, an all-new cabin interior developed by the US company Nordam, new Western avionics (their installation was revealed by a protruding white dielectric panel between the splayed ventral fins, among other things), an oxygen system and an upgraded air conditioning system.

The prototype Y7-100 was converted from a standard Y7 registered B-3499 (c/n 03702) which arrived at Hong Kong-Kai Tak airport for conversion on 27th December 1984 and was redelivered on 16th August 1985. Full-scale production started in 1986 and the Y7-100 was built (or refitted) chiefly for export.

Y7-100C freighter

An all-cargo version of the Y7-100 (with no large cargo door or rear loading ramp) was developed as the Y7-100C (C for cargo). This version was built both for the home market and for export; sub-variants designated Y7-100C1, Y7-100C2 and Y7-100C3 (all with a crew of five) were available.

Y7-100 geophysical survey aircraft

Y7-100 B-3445 operated by Sichuan Tri-Star General Aviation Co. was converted for geophysical survey. The mission equipment was supplied by China Electronics Technology Corporation (CETC Deqing Huaying Electronics); the aircraft had a large cylindrical sensor pod low on the port side centre fuselage sides and a ventral 'tub' radome further forward.

Y7-200 airliner

This version based on the Y7-100 was powered by 2,900-ehp WJ-5A-1 turboprops.

Y7-100C RDPL-3.4119 in old Lao Aviation livery taxies after arriving at Vientiane-Wattay.

Y7-200A airliner

Broadening co-operation with the Western world in the late 1980s put China in a position to upgrade its commercial aircraft designs. Thus the Y7-200 underwent a major redesign in the early 1990s; the result was the emergence of the much-improved Y7-200A.

The aircraft was powered by Pratt & Whitney Canada PW127C turboprops driving American-made Hamilton Standard 247F-1 four-bladed composite propellers of 3.96 m (13 ft 0 in) diameter; the new powerplant was identifiable by the reshaped engine air intakes, longer propeller spinners and slightly curved propeller blades. The rear end of the starboard nacelle housed an Allied Signal GTCP36-150 auxiliary power unit.

The most obvious recognition feature, however, was the recontoured drooped nose and a new flightdeck glazing offering an improved field of view and giving the aircraft a certain similarity to the Bombardier (de Havilland Canada) DHC-8 Dash 8. The fuselage was stretched 0.74 m (2 ft 5¼ in) ahead of the wings and the emergency exits were enlarged from 0.5 x 0.6 m (1 ft 7⅝ in x 1 ft 11⅝ in) to 0.927 x 0.6 m (3 ft 0½ in x 1 ft 11⅝ in). The forward baggage door was also resized from 1.2 x 1.1 m (3 ft 11¼ in x 3 ft 7⅜ in) to 1.19 x 1.22 m (3 ft 10¾ in x 4 ft 0 in). The winglets were deleted.

The Y7-200A had western avionics (including a Rockwell Collins EFIS-85 electronic flight instrumentation system), a two-man flightdeck and a restyled cabin to give a 'wide-body look' for added passenger appeal. The stretched fuselage made it possible to increase the maximum seating capacity to 60 (the standard configuration was a 56-seater); however, the maximum take-off weight remained unchanged at 21.8 tons (48,060 lb).

Registered B-570L, the prototype (c/n 007A01) appeared in early 1995 (the first sighting dates back to 20th March) and was publicly unveiled at Airshow China '96 held at Zhuhai-Sanzao airport in November 1996. The Y7-200A entered limited production in 1999, with launch customer ACA Air Chang'an Airlines taking delivery of the first two aircraft – B-3720 (c/n 200-0001) and B-3721 (c/n 200-0003) – in March. Y7-200A c/n 200-0002 must have been a ground test article. Production examples had PW127J turboprops delivering 2,880 ehp for take-off and 2,240 ehp for cruise flight.

'9037 Red', a Y7-100 in service with the PLANAF.

The Y7-200A prototype, B-570L, shows the new nose profile, new powerplant and fuselage stretch.

Y7-200B airliner

This version was basically similar to the Y7-100, retaining the original nose design and WJ-5A-1G engines. However, it incorporated a 0.23-m (9 1/16 in) fuselage stretch ahead of the wings and featured enlarged emergency exits while lacking winglets. Also, the wing airfoil was slightly different (with a modified leading edge to improve the stalling characteristics) and ground spoilers added. The prototype was registered B-528L.

Y7E

Mention has been made in the popular press of the Y7E version having improved 'hot-and-

'82701 White', an HYJ-7 navigator trainer of the PLANAF 20th Regiment.

MA60 demonstrator B-3429 takes off, showing the closely spaced rectangular windows.

An MA60 destined for Air Zimbabwe with the test registration B-674L.

high' performance. This version fitted with a different (and probably more powerful) APU first flew on 5th July 1994. Unfortunately no further details are available.

HYJ-7 bomber trainer

As the Harbin HJ-5 pilot trainer and Shijiazhuang YJ-5 navigator trainer used for training the crews of H-6 heavy bombers grew obsolescent, the Xian Aircraft Company developed a special trainer version of the Y7-100 to replace both of these types. Designated HYJ-7, the aircraft featured a large teardrop-shaped glazed fairing on the starboard side (in lieu of the baggage door) enabling the trainees to use a stabilised HM-1A bombing sight; it was equipped with a bomb-aiming radar in a ventral teardrop radome and fitted with shackles for practice bomblets. A TNL-7880 combined navigation system was also fitted; it was probably housed in elongated fairings on the centre fuselage sides.

MA60 (Y7-MA60) airliner

A further Westernised derivative incorporating features of the Y7-200A is the Y7-MA60 or simply MA60 (MA stands for 'Modern Ark' while 60 indicates the maximum seating capacity). The objective of the modernisation was to bring the aircraft in line with the new, more stringent Chinese airworthiness requirements of 2000 (which the Y7 could no longer meet) and add customer appeal by improving reliability, reducing operating/maintenance costs and enhancing passenger comfort.

The cabin windows are rectangular, not circular, and the window pitch is reduced to ensure the passengers have a good field of view. (This indicates the fuselage structure is new, with closer-spaced frames; yet the fuselage width of 2.9 m (9 ft 6⅛ in) is unchanged.) The emergency exits are located symmetrically ahead of the wings, not staggered as on the basic Y7 (including the Y7-200A). The new windows and relocated exits, together with the restyled nose, are the MA60's main external identification feature.

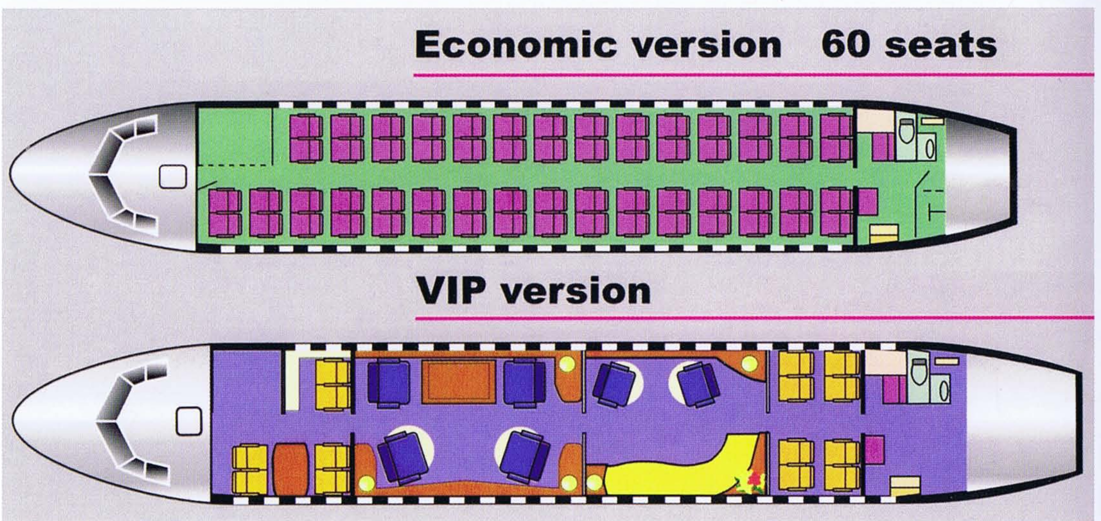
Again, the aircraft is powered by Pratt & Whitney Canada PW127J turboprops driving slightly different Hamilton Sundstrand 247F-3 four-bladed propellers; a Honeywell GTCP36-150 (CY) APU is fitted. The fuel capacity is increased from the Y7-100's 5,550 litres (1,220 Imp gal) to 7,200 litres (1,584 Imp gal).

The MA60 is equipped with digital avionics which permit ICAO Cat II operations. The two-man flightdeck features a Rockwell Collins EFIS-85(B14) electronic flight instrumentation system with four liquid-crystal displays. The avionics include a WXR-350 weather radar, an APS-85 autopilot, an AHS-85 attitude & heading reference system (all likewise by Rockwell Collins), a Universal UNS-1M navigation system, a Honeywell CAS-67B traffic collision avoidance system, a Hamilton Sundstrand Mk VIII ground proximity warning system etc.

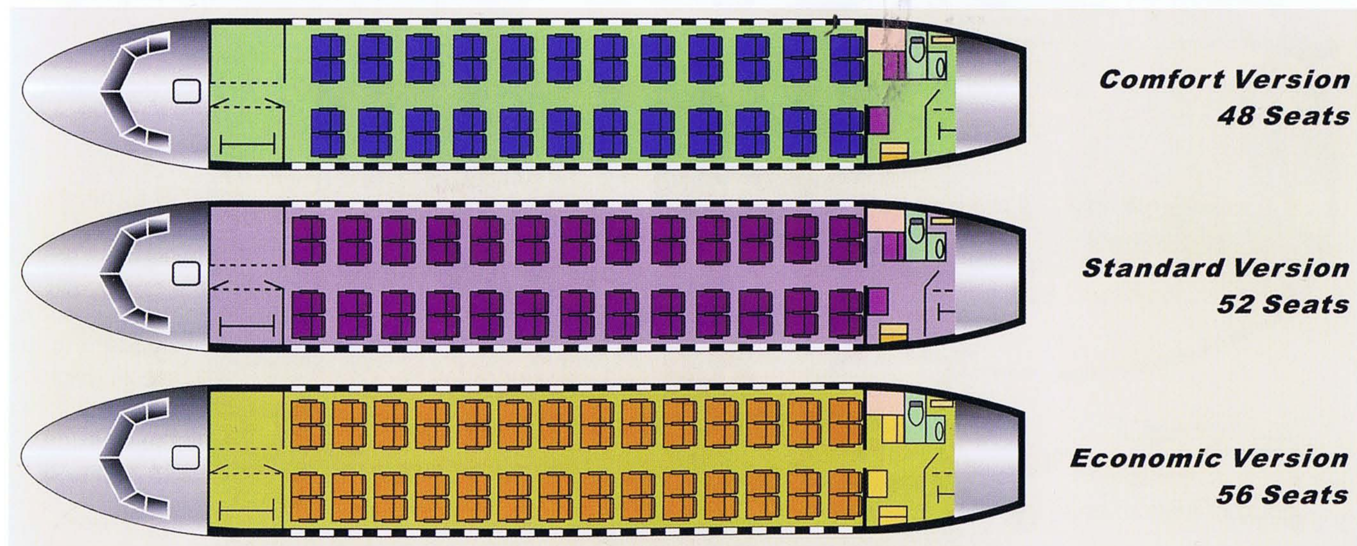
Changes have been made to other systems, too. In particular, the wings, tail unit and engine air intakes have pneumatic de-icer boots instead of electric de-icers. The main landing gear units are equipped with carbon brakes.

In airline configuration the aircraft seats 48 passengers four-abreast in the so-called comfort version, 52 in the standard version and 56 in the economy version (with 12, 13 and 14 rows of seats respectively). The maximum seating capacity of 60 is obtained by replacing the port side wardrobe at the front of the cabin with two more pairs of seats. Executive and VIP versions are also available. An air ambulance version is also offered.

A three-view drawing of the MA60.



Two of the interior layouts offered for the MA60.



More cabin layouts offered for the MA60.

Gaudily painted Sichuan Airlines MA60 B-3426 carries panda art on the nose and the engine nacelles.

The MA60 was first unveiled in model form at the Asian Aerospace 2000 airshow in Singapore in February 2000. Bearing the test registration B-559L, the prototype (c/n 0101) reportedly made its first flight on 12th March 2000. A type certificate was issued as early as 22nd June that year and the prototype was delivered to launch customer Sichuan Airlines in August as B-3425 No. 2 (the registration was inherited from a Soviet-built An-24). Other domestic customers included China Northern Airlines and Wuhan Airlines in 2002, and the manufacturer estimated that as many as 400 MA60s could be built for the home market by 2018. Export orders came from Lao Aviation, Air Congo International, Merpati, Air Zimbabwe, Air Fiji and, on the military side, TAM Bolivia and the Zambian Air Force.

A drawing from an MA60 ad showing the MA60-MPA ASW version, the MA60H freighter and an ambulance version.

Y7G airliner

The Y7G is a passenger version developed for the PLAAF. Basically it is the MA60 with the Canadian engines and American avionics replaced with WJ-5A-1G engines and indigenous avionics. At least seven such aircraft are operated by China United Airlines, the PLAAF's commercial division.

MA60 cargo/combi version

An all-cargo or combi version with a side cargo door aft of the wings and a 5,500-kg (12,125-lb) maximum payload is also being promoted, as is an air ambulance version. This version is to be powered by PW127G engines.

MA60-100 airliner

An improved version of the airliner was announced for 2002. The MA60-100 was to incorporate weight-saving measures cutting the empty weight by some 400 kg (880 lb), modifications aimed at reducing drag and an upgraded Rockwell Collins Pro Line 21 avionics suite. The design changes were to give the aircraft a 900 kg (1,984 lb) higher maximum take-off weight in 'hot-and-high' conditions, an increase in service ceiling and a 300-km (186-mile) increase in range.

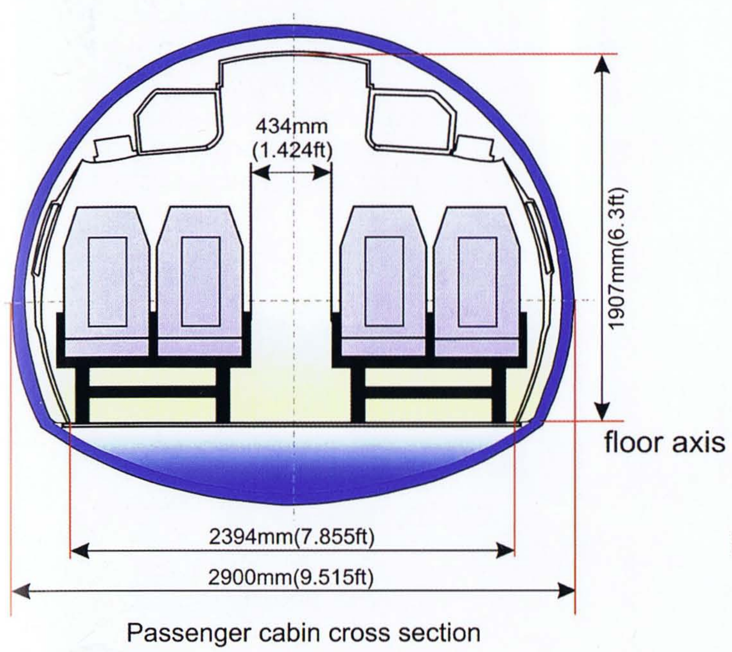
The flightdeck and cabin of the MA60. The pictures below show the cabin cross-section.

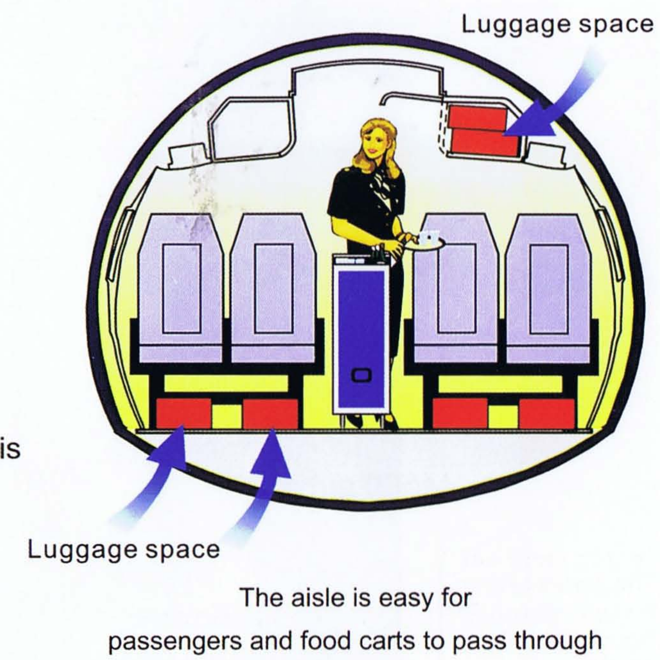
MA40 airliner (project)

This projected derivative of the MA60 announced for 2002 differs in having a shorter fuselage reducing the maximum seating capacity to 40.

MA60-MPA Fearless Albatross maritime patrol/ASW aircraft (project)

A version of the MA60 adapted for maritime patrol and anti-submarine warfare (ASW) duties was unveiled in model form at Airshow





The Y7G is outwardly identical to the MA60. This one is a military example in China United Airlines livery.

China 2002. Apart from patrolling the economic exclusion zone (EEZ), its missions were to include search and rescue (SAR) and environmental protection. Originally known as the Y7H-200BF but later redesignated MA60-MPA (maritime patrol aircraft), the naval version bears the popular name Fearless Albatross – the Chinese do have a tradition of giving lofty names to aircraft and what-not. Outwardly it differs from the standard airliner in having an extended and drooped nose, which houses a search radar with a 360° field of view, cigar-shaped conformal fuel tanks low on the centre fuselage sides extending the range to an estimated 2,500 km (1,553 miles) and, according to some drawings, a magnetic anomaly detector (MAD) 'stinger' extending aft from the tailcone. The aircraft is also to be equipped with low light level TV/forward-looking infrared (LLLTV/FLIR) systems.

The outer wings fitted with new raked tips feature four pylons allowing anti-shipping missiles and other external stores to be carried. Two more external stores hardpoints are located on the centre fuselage. The fuselage hardpoints each have a capacity of 1,000 kg (2,205 lb) and can each carry two torpedoes, a 1,000-kg bomb, a sonobuoy container or a cannon pod. The inboard wing pylons with a capacity of 1,500 kg (3,310 lb) each can carry drop tanks, anti-shipping missiles or air-to-air missiles; the outboard wing pylons with a capacity of 500 kg (1,102 lb) each are suitable for a podded searchlight, single torpedoes, cannon pods, 500-kg bombs or AAMs.

The official delivery ceremony of Lao Airlines' first MA60 airliner, RDPL-34168.

Y7H (Y14) military transport

As China had purchased the An-26 tactical transport (NATO reporting name *Curl*) from the USSR, the local aircraft industry used the experience accumulated with the An-24/Y7 to reverse-engineer this machine successfully as well. The An-26 was a direct derivative of the An-24RT transport introducing a new rear fuselage design – the inconvenient ventral cargo hatch was replaced by a large loading ramp of patented Antonov design that could either hinge down conventionally for loading/unloading vehicles and embarking/disembarking personnel or slide forward beneath the fuselage for loading from a truck bed and for paradropping.

The Zambia Air Force's VIP configured MA60, AF607.

A model of the projected MA60-MPA Fearless Albatross ASW aircraft.

The Xian Aircraft Co.'s Y7H demonstrator disgorges an automobile.

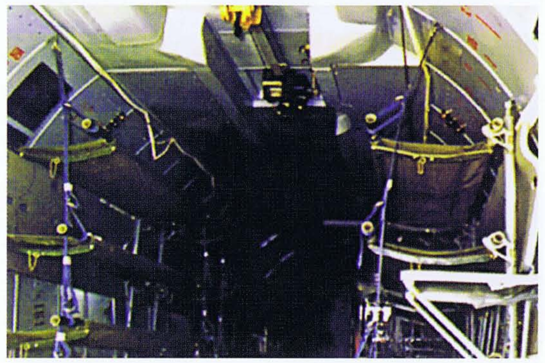
The An-26 copy intended for the PLAAF was originally designated Y14-100. Powered by uprated 3,050-ehp WJ5E engines (the Chinese version of the AI-24VT) driving Baoding J16-G10A propellers plus a 900-kgp (1,985-lbst) PY19A-300 turbojet booster/APU in the starboard engine nacelle, the prototype took to the air for the first time in late 1988. (The designation PY19A-300 referred to the Chinese version of the Tumanskiy RU19A-300, obviously being a corruption of the Cyrillic transcription).

Upon completion of the test programme the aircraft entered production as the Y7H (*Hao* = cargo). It was introduced into the PLAAF inventory in 1992.

Y7H-500 and Y7H-500A cargo aircraft

On 24th March 1992 the Xian Aircraft Co. began testing a commercial version of the

A PLA Army Aviation Y7H serialled LH94004.



The cabin of the Y7H in cargo, troopship and medevac configurations.

Y7H designated Y7H-500. The aircraft entered low-rate production, receiving its type certificate in December 1993. A somewhat more expensive variant, the Y7H-500A equipped with Western avionics, was offered for export. The performance of the Y7H and Y7H-500 differed little from that of their Soviet-built counterparts.

No information concerning the number of Y7Hs and Y7H-500s built has been published. According to the fragmentary information available, the production rate was low and by 1995 only two such aircraft (!) had been built.

Y7H-300 military transport

The export version of the Y-7H military transport is designated Y7H-300. One such aircraft was delivered to Mauritania in 1997.

Y7H ELINT version (?)

At least two Y7Hs operated by the PLAAF and serialled '4520 Red' (c/n 027H02 – that is, Batch 02, Y7H, 02nd aircraft in the batch) and '5020 Red' have been converted for ELINT duties – or ECM. Outwardly they differ from the standard transport in having a fairly large round dielectric blister located ventrally amidships. Also, '4520 Red' carries small cigar-shaped flare dispenser pods, using two of the four bomb racks that can be fitted to the lower fuselage sides of any An-26. However, these have been reported as equipment for dispersing clouds.

Specifications of the Y7 family

	Y7-100	Y7-200A	MA60	Y7H
Wing span	29.666 m (97 ft 4 in)*	29.2 m (95 ft 9½ in)	29.2 m (95 ft 9½ in)	29.2 m (95 ft 9½ in)
Wing aspect ratio	11.69	11.4	11.4	11.4
Length overall	24.218 m (79 ft 5½ in)	24.708 m (81 ft 0¾ in)	24.71 m (81 ft 0⁵³⁄₆₄ in)	23.8 m (78 ft 1 in)
Height on ground	8.553 m (28 ft 0¾ in)	8.548 m (28 ft 0½ in)	8.853 m (29 ft 0 in)	8.585 m (28 ft 2 in)
Tailplane span	9.08 m (29 ft 9½ in)	9.996 m (32 ft 9¾ in)	9.996 m (32 ft 9¾ in)	9.973 m (32 ft 8⅝ in)
Wheel track	7.9 m (25 ft 11 in)	7.9 m (25 ft 11 in)	7.9 m (25 ft 11 in)	7.9 m (25 ft 11 in)
Wheelbase	7.9 m (25 ft 11 in)	8.598 m (28 ft 2½ in)	9.564 m (31 ft 4½ in)	7.9 m (25 ft 11 in)
Wing area, m² (sq ft)	75.26 (810.1)	n.a.	74.98 (801.7)	74.98 (801.7)
Operating weight empty, kg (lb)	14,988 (33,042)	14,000 (30,865)	13,700 (30,200)	n.a.
Fuel load, kg (lb)	4,790 (10,560)	4,000 (8,818)	4,030 (8,884); 7,500 (16,535) ‡	5,500 (12,125)
Max payload, kg (lb)	5,500 (12,125)	5,200 (11,464)	5,500 (12,125)	5,500 (12,125)
Max take-off weight, kg (lb)	21,800 (48,060)	21,800 (48,060)	21,800 (48,060)	24,230 (53,430)
Max landing weight, kg (lb)	21,800 (48,060)	21,200 (46,738)	21,600 (47,620)	n.a.
Max zero-fuel weight, kg (lb)	19,655 (43,332)	19,500 (42,990)	19,200 (42,330)	n.a.
Max level speed, km/h (mph)	503 (313)	n.a.	n.a.	540 (336)
Economic cruising speed at 6,000 m (19,685 ft), km/h (mph)	423 (263)	460 (286)	n.a.	435-480 (270-298)
Service ceiling, m (ft)	8,750 (28,700) †	8,870 (29,100)	7,620 (29,100); 8,500 (27,880)	7,500 (24,600)
Take-off run at max TOW, m (ft)	640 (2,100)	n.a.	810 (2,660)	n.a.
Landing run at max landing weight, m (ft)	645 (2,117)	n.a.	760 (2,500)	n.a.
Range, km (miles):				
max payload	910 (565)	1,100 (683)	1,600 (993)	n.a.
max standard fuel	1,982 (1,231)	2,650 (1,646)	2,450 (1,521)	n.a.
Crew	3	2	2	3

* over winglets
† with a 21,000 kg (46,297 lb) AUW
‡ MA60-MPA

MA60H-500 (MA60M) military transport

Predictably, the advent of the MA60 airliner led to the appearance of a similarly upgraded transport version combining the new nose, powerplant, systems and avionics with the Y7H's cargo ramp. The transport version is referred to variously as the MA60H-500 or the MA60M (military). It is capable of transporting 40 troops with full kit; in medevac configuration it can be fitted out for transporting 24 stretcher cases plus a medical attendant.

A prototype was built in 2004, being operated by the China Flight Test Establishment (CFTE) with the serial 073.

***

Despite all the efforts undertaken by Xian Aircraft Company (XAC), An-24 production in China never reached the intended scale. Only 62 'straight' Y7s and a little more than 50 Y7-100s had been manufactured by the turn of the century. The reason may be that the Y7 was a comparatively low-priority programme, the Chinese aircraft industry being more concerned with producing the Shaanxi Y8. The Chinese policy of reverse-engineering Antonov designs did not help either; people are touchy about copyright issues, and the Antonov Aviation Scientific & Technical Complex and associated enterprises were justifiably alarmed and irritated about the Chinese copying and modifying their designs without as much as a by your leave. In 2000, however, this was finally resolved and a good working relationship re-established, enabling the Chinese aircraft industry to work with Antonov on a perfectly legal basis.

A model of the projected MA60-500 transport (alias MA60H-500 or MA60M).

The MA600 prototype in the XAC assembly shop. The most obvious external difference from the MA60 is the forward location of the entry door with integral airstairs.

MA600 airliner (project)

In 2008 XAC developed a much-improved version of the MA60 designated MA600. The prototype was completed on 29th June.

MA700 airliner (project)

Another turboprop airliner project under development by XAC in 2008 is the 70-seat MA700. No details have been revealed yet.

Shaanxi Y8 family

The PLAAF chose the Antonov An-12BP four-turboprop transport (NATO codename *Cub-A*) to fill a heavy transport aircraft requirement. Predictably, the Chinese aircraft industry sought to acquire licence manufacturing rights for the type. Beyond the Great Wall the *Cub* – known

The first Chinese-built Shaanxi Y8s were outwardly identical to the Soviet-built An-12BPs supplied to China, an example of which (B-3152) is seen here preserved at Tianjin.

Although it is operated by the Sri Lankan Air Force, CR-873 is not an export Y8D but a second-hand commercial Y8B, as indicated by the basic livery of the Chinese carrier ACA Air Chang'an Airlines.

'182 Black', the prototype of the fully pressurised Y8C, in AVIC demonstrator colours at Zhuhai-Sanzao during Airshow China '96.

locally as the Y8 – took its own line of development, and new versions still keep appearing!

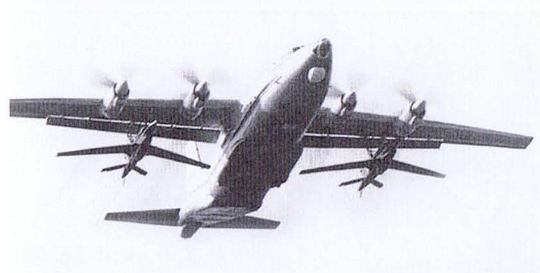
Y8 military transport

China started gearing up for An-12 production in 1960 – that is, immediately before the rift in Sino-Soviet relations. The latter (or rather the events that caused it) came at a most unfortunate time. According to Prime Minister Chou En-Lai's plan the Chinese aircraft industry was to proceed from copying Soviet designs to developing and manufacturing indigenous aircraft. However, this plan suffered a serious setback because of the 'Cultural Revolution', which had a huge negative effect on the national economy.

A full set of manufacturing drawings was released in February 1972. Originally the aircraft factory in Xian was to build the *Cub* but the 'Cultural Revolution' put these plans on hold, and it was not until 1972 that the work resumed. A year later, however, all the jigs and tooling for Y8 production, together with all components manufactured so far, were transferred to the new Shaanxi Transport Aircraft Factory in Hanchung, also in Shaanxi Province.

The first prototype Y8 (c/n 000801 – that is, Batch 00, 08 = Y8, 01st aircraft in the batch) assembled from Xian-manufactured and Soviet-supplied components was completed on 10th December 1974 and took to the air on 25th December; the crew was captained by Li Jung-rui. The first locally-manufactured

Another Y8C in a very similar colour scheme – or possibly the same aircraft at a later date – with the temporary (Class B) Chinese civil registration B-504L.



The prototype of the Y8E drone launcher aircraft, '4139 Red', with a WZ-5 (Chang Hong-1) drone attached.

Close-up of the drone and of the lattice-like rack to which it is attached.

Above left: Y8E '4139 Red' climbs away, toting two WZ-5 drones.

example followed almost exactly a year later, on 29th December 1975. Destructive testing of a static test airframe was completed on 29th September 1976 and the Y8 received its type certificate in February 1980.

The 4,250-ehp AI-20K engine was also reverse-engineered and put into production by the Zhuzhou Engine Factory as the WJ-6, while the Chinese copy of the AV-68 propeller was designated J17-G13. Chinese efforts to improve the reliability of the engine paralleled those in the USSR, and in due course the TBO of the WJ-6 was increased from 300 to 2,000 hours. The TG-16 APU was likewise copied and put into production at Xian as the WDZ-1.

Initial production aircraft assembled from Soviet-made components and on Soviet-supplied jigs were almost identical to genuine Soviet-built An-12Bs with a tail gunner's station, having the same nose contour. Soon, however, a longer and more pointed nose borrowed from the Tu-16 *Badger-A* bomber was grafted on ahead of the flightdeck glazing, giving the Y8 a distinctive 'Pinocchio look'. It is not known whether this was meant to improve the navigator's working conditions or to provide commonality with the Tu-16, which was manufactured in Xian as the H-6. Also, the DB-65U tail turret was replaced by a DK-7 turret mounting two AM-23 cannons with 500 rpg, likewise borrowed from the Tu-16; it was of basically cylindrical shape, not spherical. The aircraft incorporated the wide cargo hatch characteristic of the An-12BP/An-12BK, with the associated bulges on the lower aft fuselage sides.

The Y8 was 34.02 m (111 ft 7⅜ in) long, with a 38.0-m (124 ft 8$\frac{1}{16}$ in) wingspan, and stood 11.16 m (36 ft 7⅜ in) high on the ground. The empty weight was 35.5 tons (78,260 lb); the aircraft had a maximum take-off weight of 61 tons (134,480 lb) and a the maximum landing weight of 58 tons (127,865 lb), hauling a 20-ton (44,090 lb) payload. The maximum speed and the cruising speed were 662 km/h (411 mph) and 550 km/h (341 mph) respectively; the aircraft had a service ceiling of 10,400 m (34,120 ft) and a ferry range of 5,615 km (3,487 miles). Thus, the performance of the Y8 matched that of the An-12B, except for the slightly longer take-off run and the slightly shorter landing run.

Interestingly, the PLAAF sometimes refers to the baseline Y8 as a 'Category I platform' – that is, for various special mission versions, such as airborne warning and control systems (AWACS), electronic warfare and intelligence (EW/ELINT), and maritime patrol. These versions are dealt with later in this chapter.

Another view of the Y8E on take-off.

The still unpainted Y8F-100 commercial transport prototype.

Y8F-100 B-3103 is one of several operated by China Postal Airlines.

Y8A military transport

In 1985 the Shaanxi Transport Aircraft Factory developed a specialised version of the Y8 optimised for rapid deployment of the PLAAF's Sikorsky S-70C helicopters to remote locations (specifically to Tibet). These military utility helicopters (despite the 'civilian' designation, they were effectively UH-60L Black Hawks with the addition of a chin-mounted search radar as fitted to the MH-60G combat SAR version) were a key asset of the PLAAF. Xu Peiling led the design effort.

Designated Y8A, the helicopter transporter featured a C-130 style one-piece cargo ramp replacing the baseline version's inward-opening doors hinged at the sides, obviating the need for detachable vehicle loading ramps. Since loading and unloading the choppers was basically a roll-on/roll-off operation, the standard overhead gantry crane was deleted to increase available 'headroom' by 120 mm ($4\frac{23}{32}$ in). A special hydraulically powered support prevented the aircraft from tipping over on its tail during loading/unloading.

The Y8A prototype first flew on 3rd November 1985; deliveries to the PLAAF began in 1987. The aircraft had the DK-7 tail turret replaced by a dished fairing similar to that of demilitarised Soviet-built *Cubs* and the gunner's station glazing was faired over (except for the side windows); the deletion of the armament was probably a weight-saving measure.

B-576L, the smartly painted Y8F-200 demonstrator. This aircraft was later converted into the first prototype of the KJ-200 'Balance Beam' AWACS.

Y8B commercial transport

Development of a commercial version for the Civil Aviation Administration of China (CAAC) – the nation's sole air carrier at the time – began in 1986. The unnecessary paradropping equipment and other military equipment items were deleted, giving a weight saving of 1,720 kg (3,790 lb). Surprisingly, the commercial variant retained the tail gunner's station, featuring the 'demilitarised' rear end treatment described above.

The Y8B prototype first flew in 1986. Testing was quite protracted and the type certificate was issued only in 1993, by which time CAAC was no longer extant, having been deregulated into numerous independent airlines back in 1987.

Y8C military transport

This upgraded version was developed with assistance from the Lockheed Company in the late 1980s. The Y8C had the same cargo ramp design as fitted to the Y8A. Unlike earlier versions, which had only a small pressurised compartment aft of the crew section to accommodate the drivers of vehicles being transported, the freight hold was fully pressurised for personnel carriage, increasing the volume of the pressurised area from 31 m^3 (1,095 cu ft) to 212 m^3 (7,847 cu ft). Hence the rear fuselage incorporated additional emergency exits, and the pressurisation/air conditioning and oxygen systems were improved.

Provisions were made for carrying standard air freight containers and pallets; the navigation and communications suites were updated. Aircraft intended for the civil market were to have the tail gunner's station deleted.

B-575L, the prototype of the 'radar-nosed' Y8F-400, wore a rather gaudy colour scheme.

This desktop model of the Y8F-600 displayed at one of the Zhuhai airshows features no other differences from the Y8F-400 than the powerplant and the forward position of the entry door; the nose and the rear fuselage with a faired-over tail gunner's station have remained unchanged.

There were plans to re-engine the aircraft with General Electric CT7 turboprops driving Western propellers (various versions of this engine are rated at 1,600-1,870 ehp). However, the Tiananmen Square events of 1989 caused a rift in Sino-American relations and the 'westernisation' plan was shelved for the time being.

The prototype, '182 Black', was converted from the first Shaanxi-built Y8 and the c/n was amended to 001802 (in Y8C c/ns the version designator is changed to 18 to stress the scope of the changes). The first flight took place on 17th December 1990. On 5th-10th November 1996 Y8C '182 Black' was displayed at Airshow China '96 in Zhuhai (Sanzao airport), wearing Aviation Industry Corporation (AVIC) demonstrator colours.

Five Y8Cs had been delivered by January 1994. The fully pressurised Y8C is referred to by the PLAAF as a 'Category II platform'.

Y8D and Y8D II export versions

A version of the military transport equipped with Litton and Collins avionics was offered for export as the Y8D. The first flight took place in 1987 and deliveries started that same year; in 1992 the original version was superseded by the upgraded Y8D II featuring Western avionics. Only eight examples of both varieties had been delivered by early 1997 (four to the Myanmar Air Force, two to the Sri Lankan Air Force and two to the Sudanese Air Force) and no further orders were placed.

All known Y8Ds except Sri Lankan Air Force CP-701 (later reserialled CR-871, c/n 060801) were demilitarised. Even so, the Sri Lankan examples were used as makeshift bombers in a manner similar to the An-12BKV. CR-871, which had a fully equipped tail turret, was shot down by Tamil Tiger separatists on 18th November 1995.

Y8E drone launcher aircraft

In 1986 the PLAAF placed a requirement for a drone launcher aircraft to replace its ageing Tu-4 'mother ships'. As recounted earlier, several of these long-range bombers – re-engined locally with WJ-6 turboprops driving J17-G13

In contrast, the actual Y8F-600 prototype (seen here during the rollout) has a redesigned nose with twin radomes (front and chin-mounted), a revised flightdeck glazing and a simple tailcone.

This Y8 in CAAC livery registered 980 is the obscure Y8H survey aircraft identifiable by the flat-bottomed bulge aft of the radome – presumably housing some kind of sensor array.

propellers – had been adapted to carry and launch two Chang Hong-1 (Long Rainbow-1) reconnaissance drones. By the end of the 1980s the Tu-4s had run out of service life and a replacement was urgently required; the Y8 was the only candidate.

The design work began in 1988. Designated Y8E, the new version of the *Cub* was the Chinese counterpart of the Lockheed DC-130E, except that it had no external fuel tanks under the wings and no guidance antenna in an undernose radome. Two lattice-like racks were fitted between the inner and outer engines for carrying the drones. The racks were similar to those of the Tu-4 drone launchers but rather longer because of the Y8's high-wing layout.

The Y8E prototype was converted in March 1990 from a standard PLAAF Y8 serialled '4139 Red'. Interestingly, the tail turret had been faired over prior to the conversion. The first test launch of a Chang Hong-1 drone was carried out successfully in October 1990. The aircraft entered service with the PLAAF at the end of the year.

There have been suggestions that the standard navigation radar might be replaced with a drone guidance antenna on the Y8E.

Y8F livestock carrier

A rather unusual version of the *Cub* created in China was the Y8F dedicated livestock carrier aircraft developed in early 1990. The freight hold featured three tiers of cages on either side accommodating up to 350 sheep or goats. The Y8F's *raison d'être* was the need to carry livestock to and from pastures in remote areas of the country, which were inaccessible (or required too much time to reach) by other kinds of transport. The first flight took place on 19th November 1988 (some sources say early 1990) and Chinese certification was achieved in 1994.

Y8F-100 commercial transport

A further upgraded 'glass-nosed' commercial version was brought out as the Y8F-100. The prototype was converted from the Y8C prototype, '182 Black'. China Postal Airlines was the launch customer for this version, taking delivery of at least five Y8F-100s – B-3101 (c/n 1001), B-3102 (c/n 1002), B-3103 (c/n 1005), B-3109 (c/n 1303) and B-3110. The aircraft listed here were delivered as 'freighters with a 16-ton (35,270-lb) payload'; hence they may be specialised mailplanes. Like the basic Y8, the aircraft had an unpressurised freight hold.

Y8F-200 (Y8F-201) commercial transport

A further version similar to the Y8F-100 but featuring a fully pressurised freight hold was designated Y8F-200. The elimination of the personnel compartment at the front allowed the internal volume to be used more fully – say, for carrying 19 LD-3 air freight containers instead of 17. The demilitarised prototype bearing no civil registration wore Y8F-201 nose titles.

Y8F-300 commercial transport

This was an upgraded civil version equipped with Western avionics, including a conventionally mounted Rockwell Collins TWR-850 weather radar in a new, shorter but more streamlined 'solid' nose, a Universal Avionics

UNS-1K flight management system, Rockwell Collins VHF-42B and HF-9000 communications radios and co on, plus an advanced cargo handling system. The 'nose job' reduced the aircraft's overall length to 32.93 m (108 ft 0½ in). The flightdeck is reconfigured for a crew of three (two pilots and a flight engineer) but the freight hold is still unpressurised. The tail gunner's station was deleted and replaced by a fairing with a sloping trailing edge. The new version was announced by the China Aircraft Technology & Industry Corporation (CATIC) at Airshow China 2000, which took place in Zhuhai on 6th-12th November 2000.

Y8F-400 commercial transport

The Y8F-400 was outwardly identical to the Y8F-300 but featured a pressurised freight hold. A desktop model displayed at Airshow China 2000 where the aircraft was announced created the impression of a new and much fatter fuselage, but such models are notoriously inaccurate.

Registered B-575L, the prototype first flew on 25th August 2001 – still with WJ-6 engines, although plans were in hand to re-engine it with Pratt & Whitney Canada PW150A turboprops driving six-bladed propellers. China Postal Airlines was reportedly the launch customer for this version, placing an order for a single example with the AVIC II concern for delivery in 2002.

Y8F-600 transport

Ten years after the Tiananmen massacre the sanctions imposed against China had been lifted, and the idea of 'westernising' the Cub was dusted off. In 1999 CATIC began development of a much-modernised version designated Y8F-600 in co-operation with the Antonov ASTC acting as a risk-sharing partner (a co-development agreement was signed on 4th November 2002). Pratt & Whitney Canada joined the programme in 2000; that year the project was unveiled at Airshow China 2000.

The Y8F-600 had a fully pressurised fuselage featuring a recontoured flightdeck section with curved windshield panels; the 'solid' nose was tipped with a thimble radome, while a second radome was mounted in the chin position, as on the standard Y8. The two-man flightdeck was equipped with an electronic flight instrumentation system (EFIS). The crew entry door was located in line with the nose gear unit instead of amidships; the rear fuselage was of oval section (not flattened from below) and the tailcone was smaller and neater, while the vertical tail had a higher aspect ratio and a full-length rudder. The Y8F-600 became the first version to feature the intended Western powerplant – 5,070-ehp PW150B turboprops driving Dowty R-408 six-bladed low-noise propellers of 4.115 m (13 ft 6 in) diameter with scimitar-shaped composite

Y8 B-4071 operated by OK Air is a geophysical survey aircraft with an MAD boom.

'9301 Black', one of the two known examples of the bizarre Y8J naval AWACS aircraft with a Racal Skymaster radar in a grossly bulged nose radome.

The Y8J in flight. The revolving radar antenna provides 360° coverage.

blades. The maximum take-off weight was increased to 65 tons (143,300 lb).

Construction of two prototypes commenced in 2000, with the intention to fly the first aircraft in late 2001. However, the programme ran into development problems, and the maiden flight did not take place until 14th January 2005. Apart from the basic transport role, the Y8F-600 was regarded by the PLAAF as a potential platform for special mission aircraft known as the 'Category III platform'.

Y8G ELINT aircraft (project – first use of designation)

Turboprop conversions of Tu-4s were used for various purposes by the Chinese; a few were operated by the People's Liberation Army Naval Air Force (PLANAF) until the early 1990s as maritime ELINT aircraft. As the need to replace the ageing *Bulls* grew increasingly acute, the Chinese aircraft industry started work on an ELINT version of the *Cub* provisionally designated Y8G. The aircraft was to feature a powerful radar and a mix of Western and indigenous mission avionics. GEC Marconi assisted with the development of the Y8G but pulled out after Tiananmen and the project was shelved before a prototype could be built. (That was not the end of it, though – see next entry.)

Y8G IFR tanker (project – second use of designation)

According to some sources, it was decided to convert the Y8G airframe, which never received its mission avionics and was sitting idle, into an in-flight refuelling tanker prototype with the same designation. Other sources, though, claim the Y8G ELINT airframe never existed and the designation was merely reallocated after the demise of the former programme.

Work on an IFR tanker version had been under way in China since the mid-1980s. The first evidence came in 1986 when a model of a tanker-configured Y8 was displayed at an aviation trade fair in Beijing. The British company Flight Refuelling Ltd. must have rendered assistance with the project because the aircraft was equipped with two compact refuelling pods under the outer wings similar to the FR Mk 32 hose drum units (HDUs) fitted to the Vickers VC10 C.1K tanker/transport. The Y8 tanker was to work primarily with Nanchang

Y8MPA (Y8X) '9271 Red' flies over the sea, showing off the blue/white colour scheme worn by most examples. Note the open camera port aft of the main gear fairing.

Q-5 fighter-bombers retrofitted with fixed IFR probes ahead of the cockpit, as was illustrated by the accompanying models of two such aircraft.

Once again, however, the project was shelved. As a result, the PLAAF and the PLANAF have to rely on HY-6 (or H-6U) and H-6DU tanker versions of the H-6 bomber for IFR capability for their tactical aircraft.

Maintenance in progress on a Y-8X (Y8MPA) maritime patrol aircraft at Dachang AB.

Y8H survey aircraft

The designation Y8H has been reported for an obscure survey version for which no official details are yet known. According to some sources, the aircraft in question is a 'glass-nosed' example wearing full CAAC colours but sporting the military-style serial '980 Black' (suggesting it is operated by the CFTE). It features a flat-bottomed bulge between the radome and the nosewheel well housing some sensor or antenna array.

Above: A fine landing study of a Y8X (serialled '9291 Red'?), showing to advantage the deeper chin radome, the dished tail fairing and the mission equipment mounted on the rear cargo door segment.

Y8 geophysical survey aircraft

A 'glass-nosed' Y8 (exact version unknown) registered B-4071 was converted for geophysical survey, with a strut-braced magnetic anomaly detector (MAD) boom protruding aft from the tail gunner's station. This aircraft wears the livery of the Chinese airline OKAir.

Y8J AWACS aircraft

In the early 1990s China purchased six to eight sets of the Skymaster L-band pulse-Doppler search radar developed by the British company Racal (now Thales) for about US$ 66 million – allegedly for use in coastal anti-smuggling missions; this deal was revealed in August 1996. The true purpose came to light in May 2000 when the *Air Forces Monthly* magazine reported that an AEW version of the Y8 had been developed for the PLANAF. No separate designation was stated at the time, but the aircraft is now known to be designated Y8J.

The aircraft has a rather bizarre appearance, featuring a bulbous drooped nose instead of the usual glazed navigator's station. The nose incorporates a large radome for the Skymaster radar; the shape of the nose is optimised to give the radar full 360° coverage. A similar 'droop-snoot' radome had been used earlier on the Britten-Norman Searchmaster – an experimental airborne early warning (AEW) version of the Britten-Norman BN-2T Defender twin-turboprop utility aircraft equipped with a Racal Searchwater radar from which the Skymaster is derived. The cargo cabin houses workstations for the mission crew, as well as an 8-kW generator powering the mission equipment. The tail gunner's station glazing is faired over. Available sources say the Y8J is based on the fully pressurised Y8C, which

This Y8X serialled '9261 Black' sports an overall gloss grey colour scheme.

Y8F-200 B-576L after conversion as the first prototype KJ-200 'Balance Beam' AWACS. The odd-looking structure atop the fuselage is the strut-mounted antenna pod under wraps.

makes sense, as the cargo cabin has to house the mission operator workstations; however, there is photoproof that the machine lacks the Y8C's one-piece cargo ramp, retaining the old-style laterally split cargo doors.

As compared to the Searchwater model (which is also fitted to the Royal Air Force's BAe Nimrod MR.2 maritime patrol aircraft and the Westland Sea King AEW.2 helicopter), the Skymaster radar offers enhanced capabilities against surface targets. With a detection range of 85 km (52.79 miles) in look-down mode and 110 km (68.32 miles) in look-up mode, the radar can be used against aircraft and ships alike and is capable of detecting objects as small as a submarine periscope within its range. The system can direct up to six interceptors towards enemy aircraft. The radar system has two crew workstations, one for target detection/identification (IFF) and one for interceptor guidance. The workstations are equipped with digital data processing, 40-mm (1.57-in) colour displays and touch-screen controls. The system utilises Thorn EMI 32-bit microprocessors and a distributed processing structure. The radar, inertial navigation system (INS) and other avionics communicate via a MIL-STD-1553B databus.

Apart from vectoring offensive and defensive aircraft towards their targets, the Y8J can provide over-the-horizon (OTH) targeting for the PLA Navy's surface ships, including *Lu-ta* and *Luhu* class destroyers. Reports on the system's detection range vary, but the provisional figure of more than 200 km (124 miles) at high altitude cited by *AFM* renders the Y8J suitable for monitoring the Strait of Taiwan.

The Y8J has a length of 34.02 m (111 ft 7⅜ in) and stands 11.6 m (38 ft 0 $^{45}/_{64}$ in) tall when parked. Empty weight is 35,488 kg (78,236 lb), the normal and maximum take-off weight being 54,000 kg (119,050 lb) and 61,000 kg (134,480 lb) respectively. The internal fuel load of 22,910 kg (50,510 lb) gives the aircraft an endurance of 10.5 hours and a ferry range of 5,620 km (3,490 miles); there is no provision for C-130 style external fuel tanks. The cruising speed is 550 km/h (341 mph) and the maximum speed 662 km/h (411 mph); the service ceiling is 10,400 m (34,120 ft) and maximum rate of climb at sea level 10 m/sec (1,970 ft/min). The take-off run is 1,270 m (4,170 ft) and the landing run 1,050 m (3,440 ft).

The prototype flew on 26th September 1998. At least two Y8Js serialled '9281 Black' and '9301 Black' are in service with the PLANAF, operating from Dachang naval air base near Shanghai. The first evidence of their operational use came in 2001 when they participated in naval exercises. They were also reported to have been chasing US Navy aircraft carrier combat groups in the East China Sea.

The second prototype KJ-200 (Y8W) was based on the Y8F-600. The still unpainted aircraft is seen here at Yanliang AB during tests; the Y8F-600's new rear fuselage and vertical tail are clearly visible.

Now wearing a two-tone grey camouflage, the second prototype KJ-200 (Y8W) is seen on approach to Yanliang AB.

Y8MPA maritime patrol/ ASW aircraft (Y8X – second use of designation)

In October 1983 the Shaanxi Aircraft Company was tasked with developing a long-range multi-mission version of the Y-8 for the PLANAF. The aircraft was to perform maritime patrol, reconnaissance, ASW and search and rescue (SAR) missions. The government directive set the first delivery date for 1984.

SAC quickly drafted a design proposal which was approved by the customer in November 1983. The design effort was completed in less than a year, involving more than 20 tests. Initially the aircraft bore the Western-style designation Y8MPA (Maritime Patrol Aircraft). The all-Western mission equipment suite included a Litton Canada AN/APS-504(V)3 search radar in a deeper, flat-bottomed chin radome to give 360° coverage (which gave the Y8MPA a certain similarity to the An-12BK), optical and infrared cameras, sonobuoys and a mission computer for processing data generated by the buoys. The rear cargo door was faired over, incorporating a large mission equipment window for sonobuoys and cameras. The tail turret was also removed and the tail gunner's station reconfigured as the sonar operator's workstation. The equipment also included defensive ECM and infrared countermeasures kits, a dual Litton LTN-72 INS and a Litton LTN-211 Omega navigation aid. Apart from the larger radome, the Y8MPA was identifiable by the sensor array on the rear segment of the cargo door and the camera port aft of the port main gear fairing (closed by a door when not in use).

The Y8MPA prototype was reportedly quasi-civil and registered B-4101; a photo of the aircraft, however, shows full PLANAF markings and the serial appears to be '9211 Red'. The first Y8MPA was delivered to the PLANAF on schedule in late 1984, and the aircraft achieved type certification in 1985.

Between March and June 1986 a Y8MPA flew five reconnaissance missions to the Xisha (Paracel), Zhongsha, and Nansha (Spratly) Islands in the South China Sea, covering a total distance of 17,000 km (10,560 miles). The flights furnished a large amount of photo intelligence on these islands, which were regarded as highly valuable to support the PLA's operation in the region in a war scenario. Since the late 1990s the Y8MPAs have been

The AWACS with a conventional rotodome based on the Y8F-400 ('T0518 Red'). Note the ventral dielectric fairing and the lateral dielectric panels ahead of the wings. Interestingly, the aircraft has had PLAAF insignia added in the top right photo.

frequently spotted over the East China Sea, shadowing foreign warships and flying near foreign airspace. Some of these aircraft are believed to be fitted with ELINT equipment. In 1993 the Y8MPA was redesignated Y8X (*Xun* – surveillance), inheriting the original designation of another transport currently known as the Y9 (which see).

KJ-200 (Y8W 'Balance Beam', 'High New 5') AWACS aircraft

In the late 1990s China started work on a tactical AWACS aircraft codenamed 'Project No. 5' or *Gaoxin* 5 ('High New 5'). The Shaanxi Y8 transport was selected as the platform. The aircraft was fitted with a linear-shape electronically steered phased-array radar similar to the Swedish Ericsson PS-890 Erieye fitted to the SAAB 340AEW (S 100B Argus) and Embraer EMB 145AEW&C (R-99A). As on these aircraft, the radar antenna arrays were housed in a slab-sided pod mounted above the centre fuselage by struts; this design is particularly suitable for smaller aircraft with limited space and payload. The radar is capable of 360° detection and tracking of air (and possibly surface) targets over the horizon. Unlike the S 100B and the R-99A, the inverted-V supporting struts were very tall and the aft-

Another view of T0518 Red, showing to advantage the (apparently dielectric) tailcone replacing the usual tail gunner's station, the rear fuselage lacking a cargo door and the soot-stained endplate fins resembling those of the An-10 airliner.

The airborne command post version of the Y8 has the same rear fuselage/tailcone design as the above AWACS, plus a teardrop-shaped dielectric blister aft of the wings over SATCOM gear. Note also the additional blade aerials on the forward fuselage.

mounted drag strut was attached to the rear pair. Because of the pod's distinctive appearance the AWACS-configured Y8 was nicknamed 'Balance Beam' by military specialists.

The first prototype (or rather technology demonstrator) was converted from a Y8F-200, making its first flight on 8th November 2001; it wore blue/white AVIC demonstrator colours and the Class B registration B-576L. The second prototype representing the definitive configuration was based on the much-improved Y8F-600 (aka the 'Category III platform'); in addition to the radar array, the machine had a dielectric tailcone, dielectric wingtip pods of cylindrical shape and a small fin-tip pod with a dielectric rear portion (probably associated with ECM).

Wearing the test serial 'T0673 Red', the still unpainted aircraft made its maiden flight on 14th January 2005. This aircraft received the service designation KJ-200 (Kong Jing-200); the definitive version is also known as the Y8W. Flight tests of the KJ-200 began at the CFTE in Yanliang, Shaanxi province. However, the programme suffered a major setback on 4th June 2006 when the second prototype crashed, killing all on board. A new prototype is reportedly under construction.

Y8 AEW

In parallel with the KJ-200 (Y8 'Balance Beam'), the Chinese aircraft industry developed and built a further AWACS version of the Cub referred to in some sources as the Y8 AEW (Airborne Early Warning). The aircraft has a conventional 'saucer' rotodome mounted aft of the wings on twin inward-canted pylons; the greater part of the rotodome is dielectric.

The existence of the 'conventional' AWACS derivative became known in 2005. An early desktop model suggested that the aircraft was

Now wearing full PLAAF colours, the Y8G is seen here on final approach.

based on one of the 'glass-nosed' versions – presumably the fully pressurised Y8C or Y8F-200. However, the actual prototype wearing a civilian-style blue/white colour scheme and the test serial 'T0518 Red' is based on the radar-nosed Y8F-400 ('Category II Platform'). Contrary to some sources, the base aircraft is not the Y8F-600 – the WJ-6A engines with four-bladed propellers, the shape of the nose and tailcone and the amidships position of the entry door prove otherwise. Directional stability is augmented by hexagonal endplate fins on the horizontal tail similar to those of the Antonov An-10/An-10A airliner from which the An-12 had been developed. The cargo

A rather crude model of a proposed AWACS version with large nose and tail radomes.

Still in primer finish, the prototype of the Y8T battlefield surveillance version comes in to land after a test flight.

ramp is eliminated, further adding similarity with the An-10. The aircraft has a ventral dielectric 'bathtub' fairing aft of the nose gear and four blade aerials mounted in tandem on top of the forward fuselage.

Y8 AWACS aircraft with nose/tail arrays (project)

There is evidence that yet another AWACS version was under development. It featured huge radomes in the nose and aft of the tail unit in a manner similar to the Royal Air Force's BAe AEW Nimrod. This is hardly a matter of chance, as the radar was almost certainly the same. The project was apparently scrapped in favour of more promising designs.

Y8G airborne command post (third use of designation?, High New 3)

An airborne command post (ABCP) version based on the Y8F-200 first flew in 2004 and was undergoing flight test at the CFTE in 2006. The originally unpainted and unserialled aircraft had a Y8F-600 style 'fat' rear fuselage lacking a cargo ramp combined with the old vertical tail and a dielectric tail fairing replacing the tail gunner's station. A second entry door was located aft of the port main gear fairing. A fairly large teardrop-shaped dielectric blister (apparently associated with satellite communications) was located dorsally aft of the wing trailing edge, and a series of blade aerials was mounted dorsally and ventrally on the forward fuselage. A small circular outlet – possibly the exhaust of an APU catering for the mission equipment – was visible on the starboard side of the rear fuselage.

Later, the ABCP gained a grey camouflage scheme and the PLAAF serial '30271 Red'. Some sources call this aircraft Y8G; the reporting name is High New 3.

These views of the Y8T show the huge SLAR cheek fairings, the centreline radome and the fin top fairing housing more antennas.

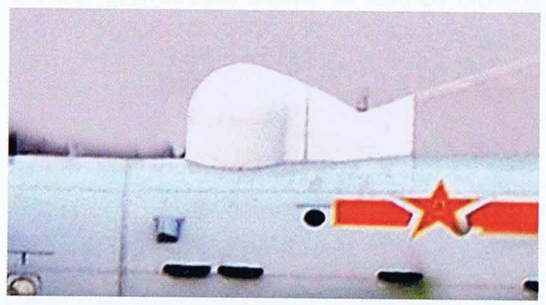
The Y8XZ psychological warfare aircraft, shows its cheek fairings and emitter aerial arrays on the rear fuselage.

An Y8CA ELINT aircraft comes into land, showing the ventral canoe fairing and the plethora of blade aerials on the rear fuselage underside.

'9351 Black', one of the PLANAF's bizarre Y8DZ electronic warfare aircraft, shows off its huge dorsal and ventral radomes and assorted aerials on the fuselage and wings. This example is operated by the 1st Independent Regiment at Laiyang.

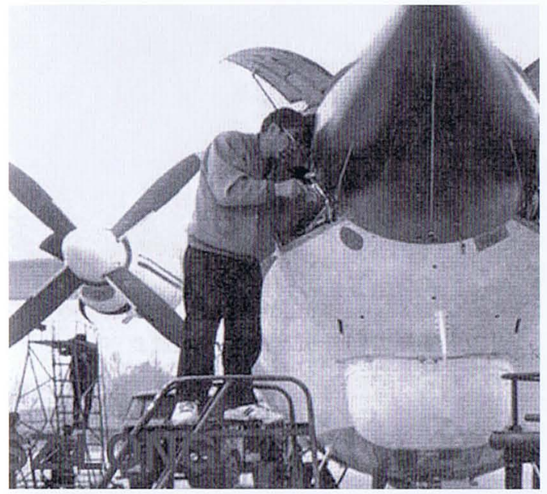
Y8T battlefield surveillance aircraft (High New 4)

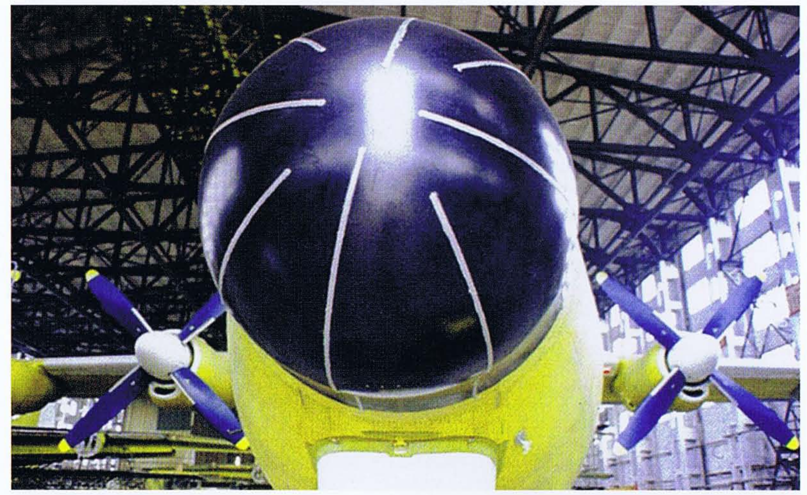
The Y8F-400 has served as the basis for a mysterious special mission aircraft designated Y8T and reported to be a battlefield surveillance aircraft similar in function to the USAF's Boeing E-8 JSTARS (Joint Surveillance/Target Attack Radar System). Some sources, though, list it as an ECM aircraft.



The dorsal antenna fairing of the Y8DZ blends into the fin fillet. Note the open air intake scoop and exhaust of the additional APU powering the mission equipment.

'9527 Black', a Y8DZ surprisingly operated by the PLANAF's Independent Helicopter Regiment.





One of the three known configurations of the CFTE's Y8CB radar testbed. A technician has opened an access cover in the adapter carrying the experimental radar and is checking the radar set.

Another configuration of the same aircraft with a hemispherical nose radome. The placement of the serial aft of the flightdeck is unusual.

The Y8T has two huge dielectric cheek fairings looking like sections of vertically positioned cylinders on the forward fuselage sides just ahead of the wings (these fairings blend into the main gear actuator fairings). These fairings may accommodate a side-looking airborne radar (SLAR) for ground surveillance. Smaller fairings also housing electronic equipment are located laterally ahead of the cheek fairings, on the centreline between the cheek fairings and at the top of the fin. The aircraft has a 'thimble' nose radome replacing the usual glazing and a 'fat' rear fuselage minus cargo ramp (that is, identical to that of the Y8 ABCP). Large blade aerials are located dorsally aft of the wings and ventrally just aft of the nose radome.

First seen in 2005, the Y8T wears a grey camouflage scheme with lighter grey undersurfaces and PLAAF insignia; the serial is '21015 Red'. The codename is High New 4.

Y8DZ (Y8JB?) ELINT aircraft (High New 2)

One of the most bizarre versions of the Cub developed in China is the Y8DZ electronic intelligence variant (the DZ suffix means *Dianzi Zhencha* – ELINT). Some sources, though, refer to this aircraft as the Y8JB.

The most obvious external identification features are the greatly enlarged chin radome and a dielectric dorsal fairing of similar shape and size located immediately ahead of the fin fillet – actually blending into it. A small thimble fairing housing antennas is mounted at the forward extremity of the navigator's station glazing frame. A huge trapezoidal aerial is located dorsally aft of the flightdeck, while the forward/centre fuselage underside mounts, consecutively, an oval fairing with two cylindri-

One more view of the Y8CB in its 'dog nose' configuration. All four engines are being worked on.

Two views of the Y8CB as used for testing the radar intended for the Chengdu J-10 fighter. Note the differing placement of the test equipment heat exchanger.

cal protuberances; a small trapezoidal aerial; a flat-bottomed elliptical fairing carrying five rod aerials, and a large blade aerial. More aerials are mounted on the rear fuselage sides, on the wing leading edge near the wingtips and under the tail gunner's station.

According to Chinese sources, the Y8DZ has a KZ800 (*Kongzhong Zaoqi* – airborne early warning) ELINT system operating in the 1 to 18 GHz frequency band and requiring a mission crew of at least three. There have been rumours that some of the mission equipment may come from the US Navy Lockheed EP-3 Orion ELINT aircraft which made an emergency landing on Hainan Island in April 2001 after colliding with a Chinese fighter. However, the equipment could just as easily be totally indigenous.

The prototype first flew on 26th August 2003. The existence of the new version came to light in the summer of 2004. At least three examples ('9351 Black', '9361 Black' and '9527 Black') are in service with the PLANAF. This version is codenamed High New 2.

Y8XZ psychological warfare aircraft (High New 7)

Another special mission version designated Y8XZ (codename High New 7) was developed for psychological operations, broadcasting radio and TV programmes to demoralise the enemy; it is thus the Chinese counterpart of the American Lockheed EC-130E *Rivet Rider*. It shares the fuselage design of the Y8T (with the thimble nose and the fat rear fuselage). However, the cheek fairings are much smaller and of semi-circular cross-section, large lateral strake aerials and a ventral 'towel rail' aerial are mounted laterally and ventrally on the rear fuselage. Like the ABCP version, the aircraft has two port side doors.

An artist's impression of a 'gunship' version based on the Y8C (note the cargo ramp).

Y8CA ECM aircraft (High New 1)

Developed as a replacement for the obsolete HD-5 ECM aircraft, the Y8CA first flew on 26th January 2000. The aircraft has a rather more conventional appearance than many special mission variants, with nothing more than a ventral canoe fairing halfway between the nose gear unit and the main gear fairings, plus an extensive farm of blade aerials on the underside of the cargo doors.

Specifications of the Y8

	Y8F-100	Y8F-200	Y8F-300	Y8F-400	Y8F-600
Powerplant	4 x WJ-6A	4 x WJ-6A	4 x WJ-6A	4 x WJ-6A	4 x PW150A
Wing span	38.015 m (124 ft 8 21/32 in)	38.015 m (124 ft 8 21/32 in)	38.015 m (124 ft 8 21/32 in)	38.015 m (124 ft 8 21/32 in)	38.015 m (124 ft 8 21/32 in)
Length overall	34.02 m (111 ft 7¼ in)	34.02 m (111 ft 7¼ in)	32.93 m (108 ft 0½ in)	32.93 m (108 ft 0½ in)	n.a.
Height on ground	11.16 m (36 ft 7½ in)	11.16 m (36 ft 7½ in)	11.16 m (36 ft 7½ in)	11.16 m (36 ft 7½ in)	n.a.
Tailplane span	12.195 m (40 ft 0½ in)	12.195 m (40 ft 0½ in)	12.195 m (40 ft 0½ in)	12.195 m (40 ft 0½ in)	12.195 m (40 ft 0½ in)
Wheel track*	4.92 m (16 ft 1 45/64 in)	4.92 m (16 ft 1 45/64 in)	4.92 m (16 ft 1 45/64 in)	4.92 m (16 ft 1 45/64 in)	4.92 m (16 ft 1 45/64 in)
Wheelbase	9.576 m (31 ft 5 in)	9.576 m (31 ft 5 in)	9.576 m (31 ft 5 in)	9.576 m (31 ft 5 in)	n.a.
Propeller diameter	4.5 m (14 ft 9 5/32 in)	4.5 m (14 ft 9 5/32 in)	4.5 m (14 ft 9 5/32 in)	4.5 m (14 ft 9 5/32 in)	4.115 m (13 ft 6 in)
Wing area, m^2 (sq ft)	121.86 (1,311.7)	121.86 (1,311.7)	121.86 (1,311.7)	121.86 (1,311.7)	121.86 (1,311.7)
Operating weight empty, kg (lb)	34,500 (76,060)	34,760 (76,635)	n.a.	34,000 (74,955)	33,500 (73,855)
Fuel load, kg (lb)	22,909 (50,505)	14,566 (32,115)	22,909 (50,505)	14,566 (32,115)	19,000 (41,888)
Maximum payload, kg (lb)	15,000 (33,070); 20,000 (44,090) †	15,000 (33,070); 20,000 (44,090) †	15,000 (33,070)	15,000 (33,070)	15,000 (33,070); 20,000 (44,090) †
Maximum take-off weight, kg (lb)	61,000 (134,480)	61,000 (134,480)	61,000 (134,480)	61,000 (134,480)	65,000 (143,300)
Maximum landing weight, kg (lb)	58,000 (127,870)	58,000 (127,870)	58,000 (127,870)	58,000 (127,870)	65,000 (143,300)
Maximum zero-fuel weight, kg (lb)	55,278 (121,865)	55,538 (122,440)	55,278 (121,865)	55,538 (122,440)	n.a.
Max level speed, km/h (mph)	662 (411)	640 (397)	662 (411)	640 (397)	650 (403)
Economic cruising speed at 7,985 m (26,200 ft), km/h (mph)	530 (329)	530 (329)	530 (329)	530 (329)	530 (329)
Service ceiling, m (ft)	10,400 (34,120)	10,050 (32,970)	10,400 (34,120)	10,050 (32,970)	10,300 (33,800)
Take-off run, m (ft)	1,270 (4,170)	1,270 (4,170)	1,270 (4,170)	1,270 (4,170)	1,540 (5,050)
Landing run from h=15 m, m (ft)	1,058 (3,475)	1,058 (3,475)	1,058 (3,475)	1,058 (3,475)	1,510 (4,955)
Range, km (miles):					
maximum payload	1,273 (791)	n.a.	n.a.	n.a.	2,000 (1,242)
maximum standard fuel	5,615 (3,489)	3,440 (2,187)	5,300 (3,289)	3,440 (2,187)	n.a.
Crew	5	5	3	3	2

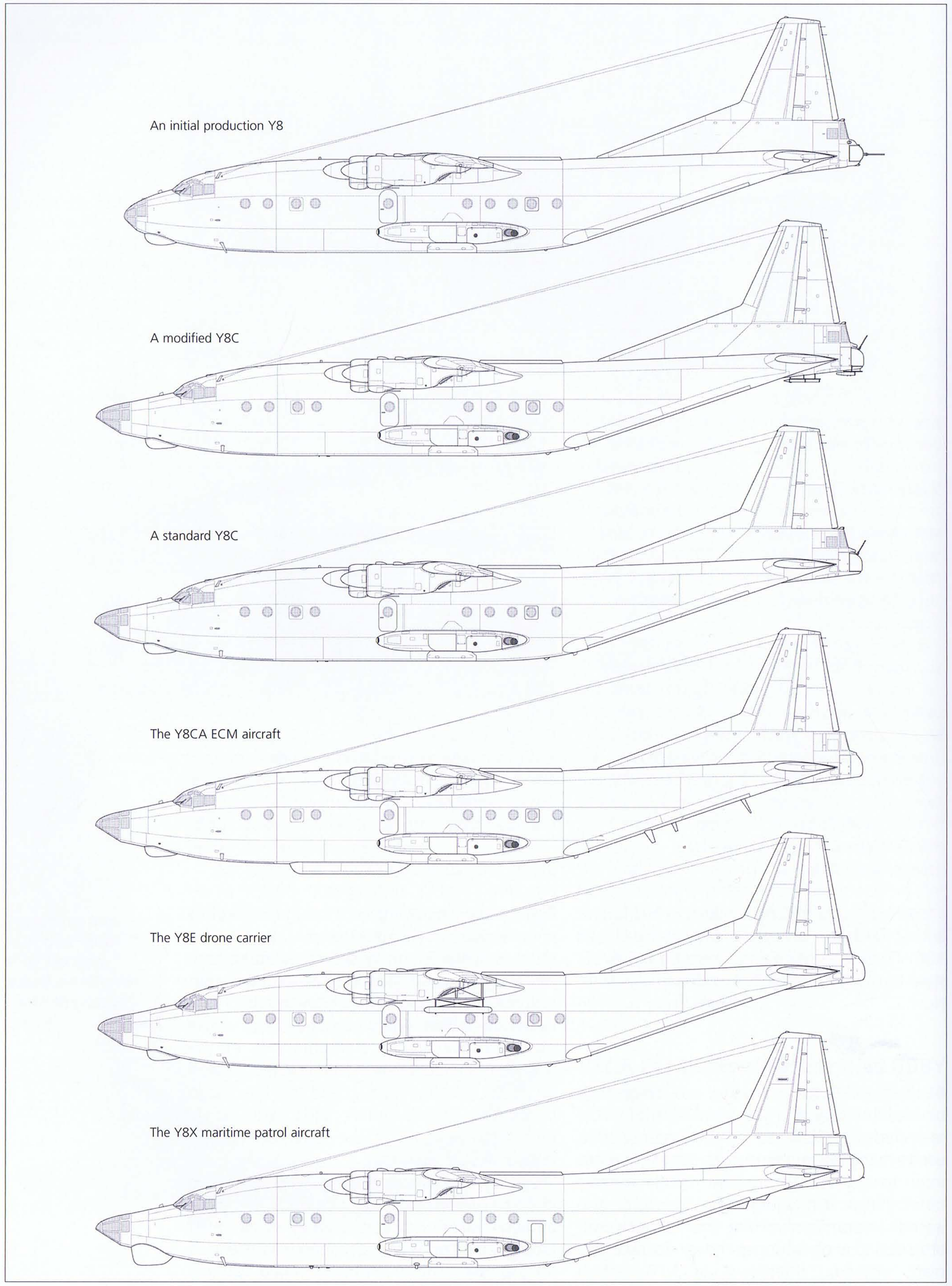
* measured by the oleos
† containerised/bulk cargo

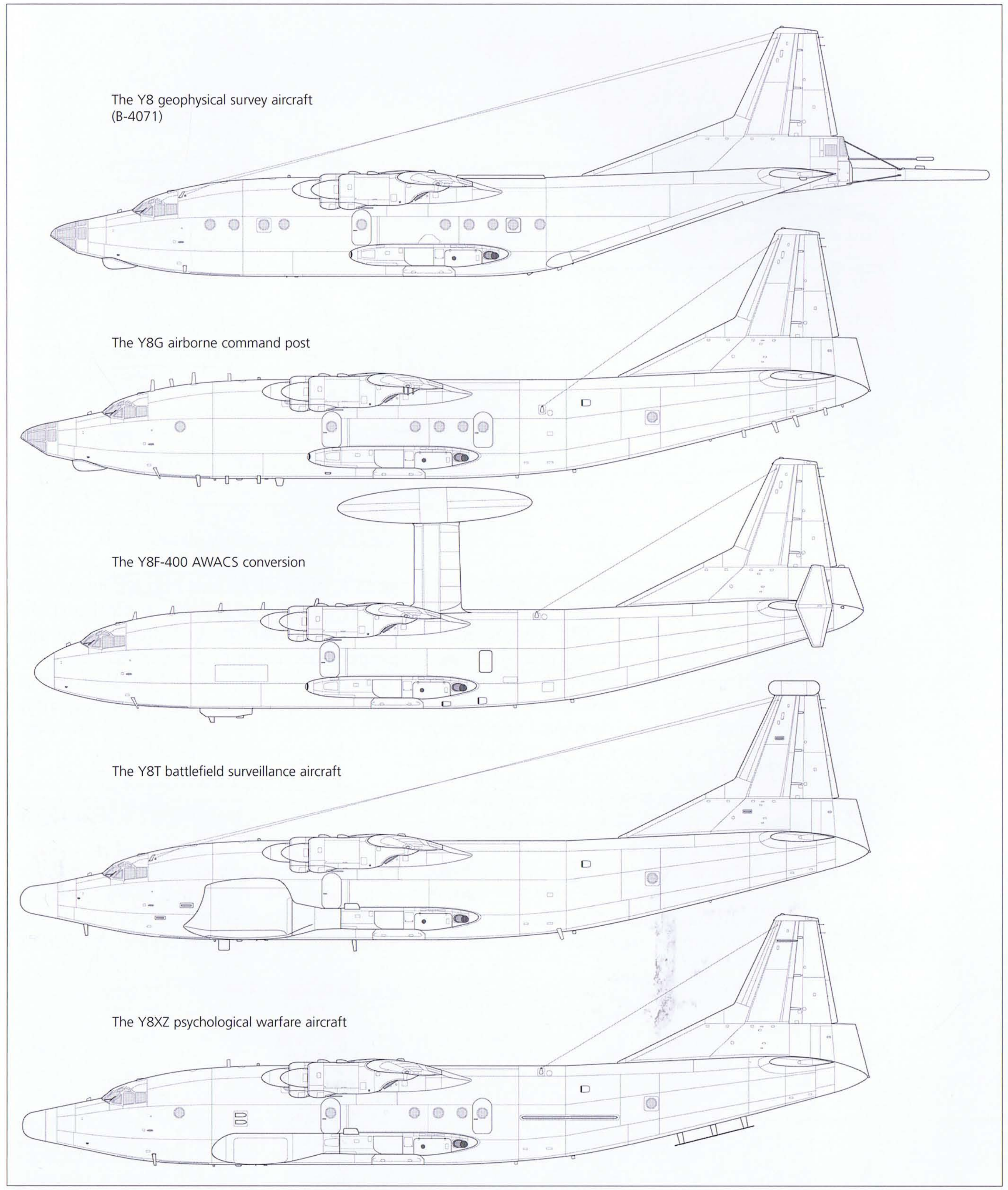
At least two Y8CAs serialled '21011 Red' and '21013 Red' are in service with the PLAAF 10th Division at Angqing, wearing a CAAC-style blue/white livery. The codename is High New 1.

Y8CB avionics testbed

At least one Y8C wearing an airline-style blue/white livery and the serial '079 Black' is operated by CFTE as an avionics testbed used in various programmes; some sources refer to this aircraft as the Y8CB. Among other things, it has played an important role in the development of fire control radar systems for China's new-generation combat aircraft, including the Chengdu J-10 tactical fighter, the Shenyang J-11 multi-role fighter and the Xian JH-7 (FBC-1) strike aircraft. The radar is installed on a special adapter supplanting the nose glazing; the standard chin radome is retained. Other non-standard features are a test equipment heat exchanger mounted low on the starboard side of the nose and a wide flat-bottomed fairing located on the centreline just ahead of the cargo ramp. The aircraft carries 'CFTE' and 'RETA' titles (the meaning of the latter acronym is unknown).

Three distinctive configurations are known. In one of them '079 Black' had a downward-angled ogival radome painted dark grey (apparently the radar in question was intended for the JH-7). The second version had a simple

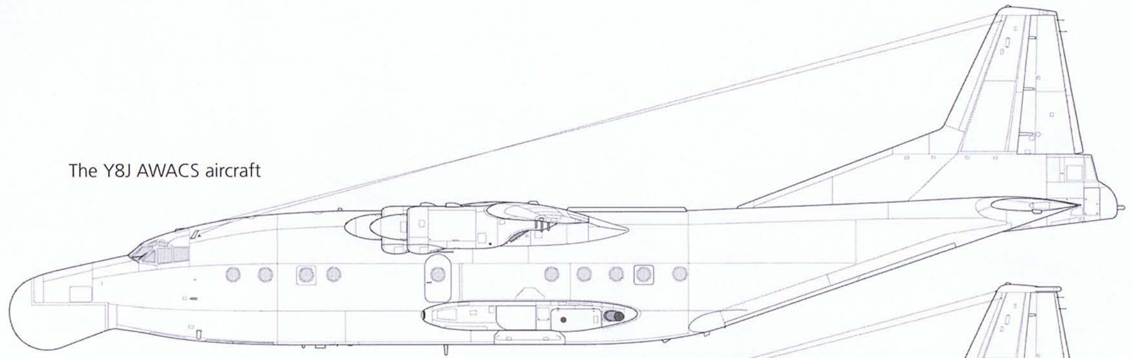




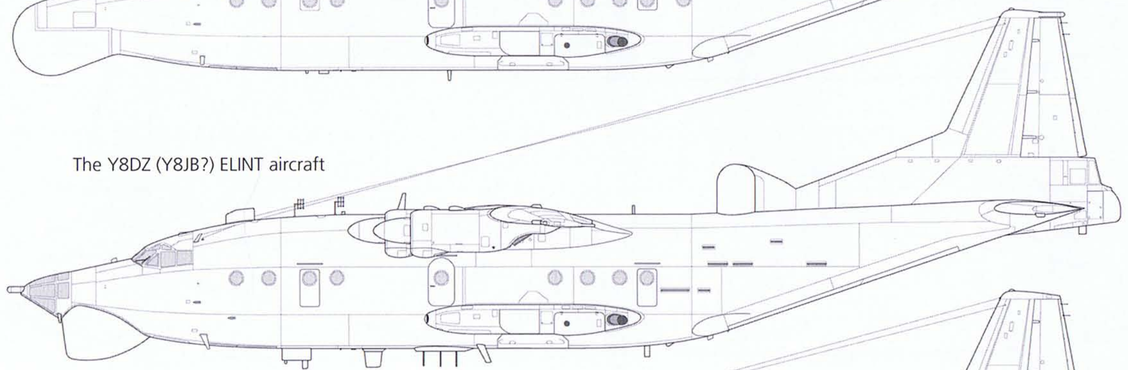
conical radome painted black. A third variant had a hemispherical nose radome; the application of this radar is unknown. This 'thimble-nosed' version figured in an advertising leaflet of AVIC I, one of whose divisions was probably responsible for the radar.

Y8AF ASW aircraft

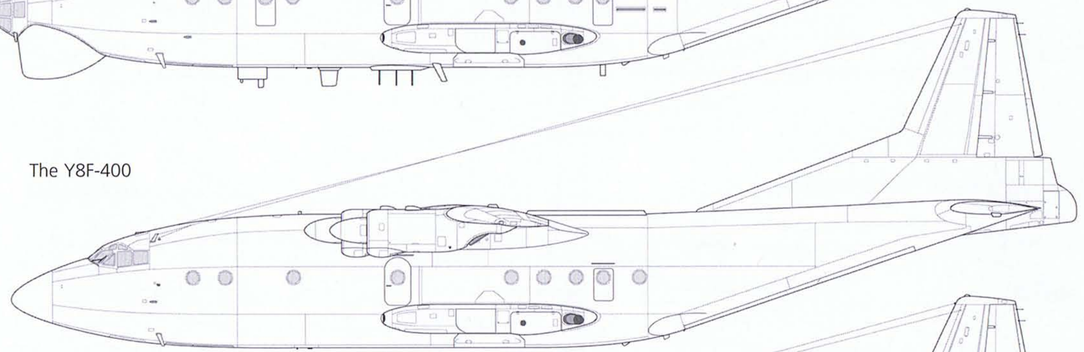
Based on the airframe of the Y8F-600, this obscure version has a magnetic anomaly detector (MAD) 'stinger' extending aft from the tailcone and a long IFR probe mounted on the flightdeck roof. No details are known.



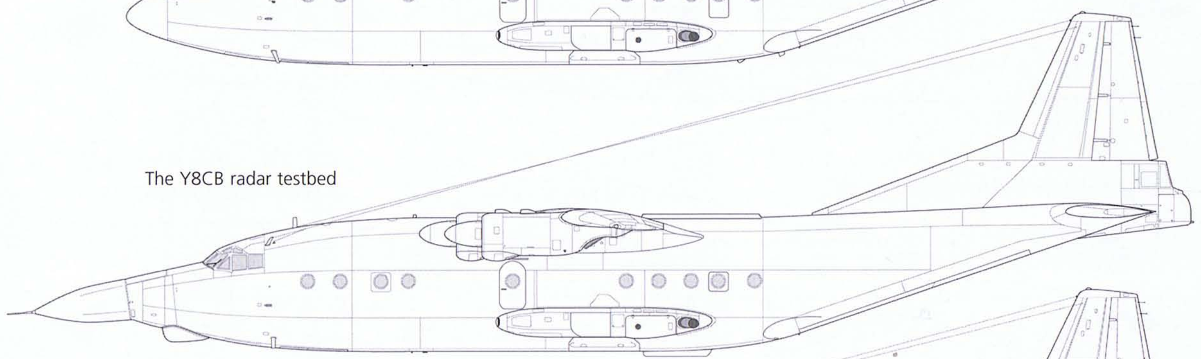
The Y8J AWACS aircraft



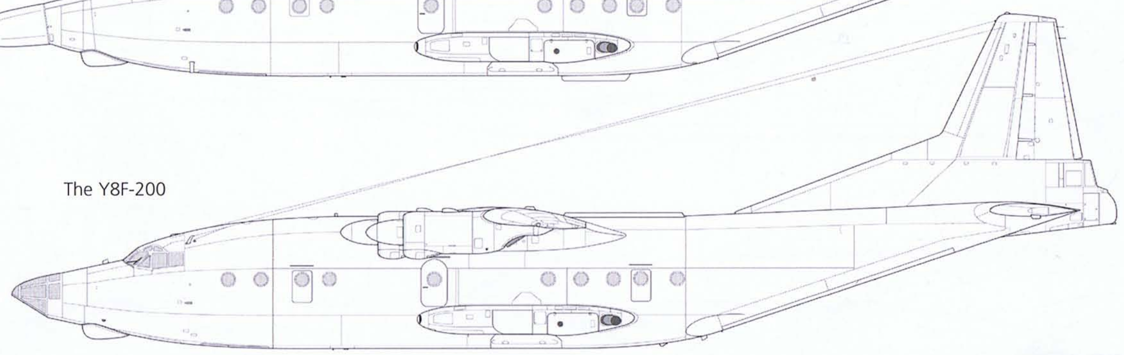
The Y8DZ (Y8JB?) ELINT aircraft



The Y8F-400



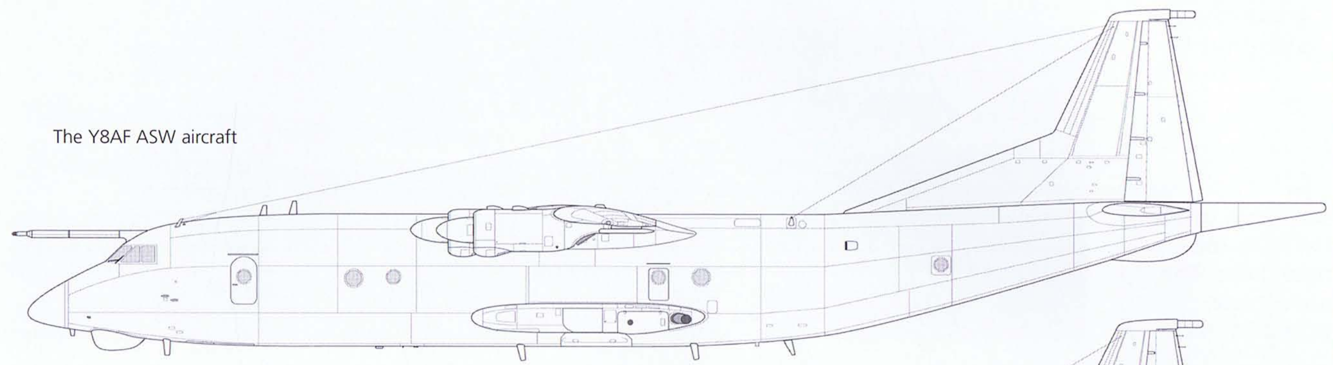
The Y8CB radar testbed



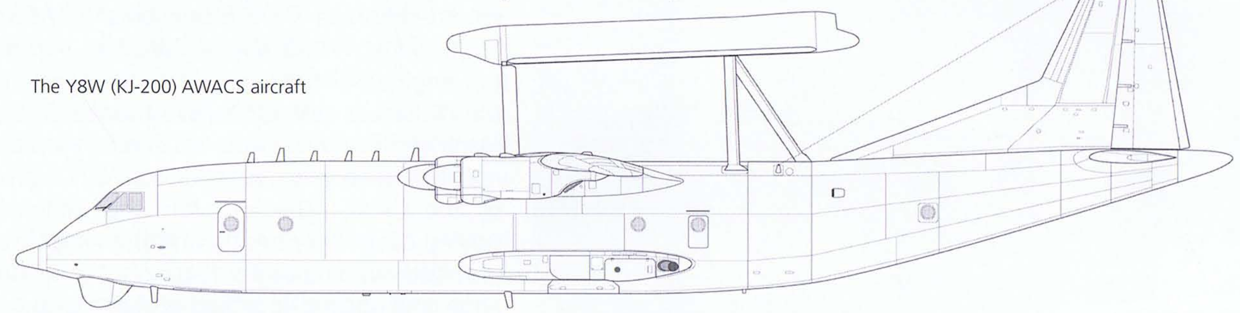
The Y8F-200

Y8 gunship (project)

An artist's impression exists showing a projected 'gunship' version of the Y8C clearly inspired by the USAF's Lockheed AC-130H Spectre and AC-130U Spooky. Two ports for heavy cannons are provided immediately aft of the port main gear fairing; additionally, three heavy machine-guns (HMGs) fire through the entry door and two port side windows in the passenger compartment aft of the flightdeck. The weapons are aimed by means of a compact fire control radar immediately ahead of the entry door (in similar manner to the AC-130) and a gyrostabilised optoelectronic surveillance/sighting system in a 'ball turret' under the nose. The optoelectronic system turret takes up the position normally occupied by the chin radome, ousting the latter to a position low on the port side of the nose. A movable floodlight is installed in a fairing on the port wing leading edge to dazzle the enemy and assist the aircraft's gunners. Additionally, fairings associated with ECM/ESM are located on the port side of the rear fuselage and at the top of the fin.



The Y8AF ASW aircraft



The Y8W (KJ-200) AWACS aircraft

Shanghai Y10 airliner

In August 1970 the Shanghai Aircraft Research Institute (SARI) began an ambitious programme to develop the first indigenous medium-haul jet airliner. Ma Fengshan, a graduate of the Jiaotong University located in Shanghai, was the project chief.

Designated Y10, the airliner bore more than a passing resemblance to the Boeing 707, giving rise to allegations that it was a copy of the US airliner. Yet it was an indigenous design having no structural commonality with the 707; it was dimensionally different, and the wing planform and nose shape were also different. In fact, development began two years before the first Boeing 707-3J6s were delivered to China – something that was made possible by a thaw in relations with the West in 1972.

The Y10 was a low-wing aircraft with an elliptical-section fuselage, moderately swept

The Y10 prototype after arriving at Nanyuan AB on 8th December 1981.

Two views of the Y10 in its ultimate guise. The aircraft was retired in 1983.

dihedral wings and swept conventional tail surfaces. The tricycle landing gear featured a forward-retracting twin-wheel nose unit and inward-retracting main units with four-wheel bogies. The four turbofan engines were housed in individual nacelles on widely spaced underwing pylons. The engines – Pratt & Whitney JT-3D-7s rated at 5,790 kgp (19,000 lbst) for take-off – were the same as on the Boeing 707-300. Originally the designers had intended to use the Chinese-built 8,165-kgp (18,000-lbst) WS-8 engine (Woshan – turbofan engine), also developed in Shanghai, but the JT-3D was selected before the WS-8 could reach certification, as the US engine would be readily available as spares for the 707s ordered by the CAAC. The Y10 had the trademark Boeing cabin door design and the wings were provided with Krueger flaps on the leading edge and spaced low/high-speed ailerons on the trailing edge – just like the 707.

The aircraft had a crew of five – two pilots, flight engineer, navigator and radio operator. The cabin permitted six-abreast seating and could be configured for 178 in a high-density layout, 149 in an all-economy layout or 124 in a mixed-class layout.

Three examples of the Y10 were built by the Shanghai aircraft factory – a static test

A very crude display model of the Y10.

This model depicts a proposed AWACS version of the Y10.

Y10 specifications

Length overall	42.93 m (140 ft 10 in)
Wing span	42.24 m (138 ft 7 in)
Height on ground	13.42 m (44 ft 0 in)
Wing area, m² (sq ft)	244.5 (2,632)
Wheel track	6.6 m (21 ft 7¾ in)
Wheelbase	14.795 m (48 ft 6½ in)
Empty weight, kg (lb)	58,120 (128,130)
Maximum take-off weight, kg (lb)	102,000 (224,870) *
Maximum fuel load, kg (lb)	51,000 (112,435)
Maximum payload, kg (lb)	16,700 (36,815)
Maximum level speed, km/h (mph)	974 (605)
Cruising speed, km/h (mph):	
maximum	917 (570)
normal	830-850 (515-528)
Landing speed, km/h (mph)	250 (155)
Service ceiling, m (ft)	12,330 (40,450)
Range, km (miles):**	
maximum payload	5,560 (3,455)
maximum fuel	8,000 (4,970)

* Some sources quote 110,227 kg (243,009 lb)
** Approximate

A production Y11 in utility transport configuration.

article, a flying prototype and a fatigue test airframe. Registered B-0002 to reflect its c/n, the sole prototype made its maiden flight on 26th September 1980, captained by Wang Jinda. It was unveiled to the public on 8th December 1981; on that occasion the aircraft carried several dozen passengers from Shanghai to Beijing.

However, the Y10 fell victim to politics from the start. For one thing, its development had been spurred by the strategic vision of an independently developed large transport plane voiced by the Chinese leader Mao Zedong. Thus, while being recognised abroad as a major technological achievement after which 'one could no longer regard China as a backward country', it was also viewed by many as no more than a political 'can-do' exercise. For another, the Y10 programme was spearheaded by Wang Hongwen, one of the Gang of Four – the chief ideologists of the 'Cultural Revolution' and associated repressions. Thus, when a new wave of reform swept the country and the cadres previously persecuted by Wang Hongwen were rehabilitated, they came back with a vengeance. The Y10 programme was cancelled in 1983 – officially due to cost reasons and outdated technology. In fact, during the airliner's maiden flights, no governmental officials dared attend the ceremonies for fear of connection to the infamous Gang of Four. B-0002 was retired in 1984 after logging 170 hours' total time in 130 flights, including seven 'hot-and-high' flights to Lhasa in Tibet. Since then, China has relied on the Soviet Union/Russia and the West as suppliers of jet airliners.

Y10 AWACS aircraft (project)

There is evidence in the form of a model that an AWACS version of the Y10 was under consideration. The concept was clearly inspired by the Boeing E-3 Sentry, and the radar antenna was to be mounted in a conventional rotodome mounted on twin pylons.

Harbin Y11 utility aircraft

In November 1974 the Chinese government issued a requirement for a light transport and

The first production Y11 (351, c/n 110101) at the PLAAF Museum. Note the HAMC logo on the tail.

Y11 specifications

	Y11	Y11B(I)
Length overall	12.017 m (39 ft 5⅛ in)	12.12 m (39 ft 9 in)
Wing span	17.0 m (55 ft 9¼ in)	17.08 m (56 ft 1 in)
Height on ground	4.64 m (15 ft 2¾ in)	5.19 m (17 ft 0 in)
Wing area, m² (sq ft)	34.0 (365.97)	34.2 (367.7)
Wing aspect ratio	8.5	n.a.
Elevator span	5.1 m (16 ft 8¾ in)	n.a.
Wheel track	3.45 m (11 ft 3¾ in)	3.45 m (11 ft 3¾ in)
Wheelbase	3.642 m (11 ft 11½ in)	n.a.
Empty weight, kg (lb)	2,050 (4,520)	2,505 (5,250)
Maximum take-off weight, kg (lb)	3,500 (7,715)	3,500 (7,715)
Maximum fuel load, kg (lb)	390 (860)	n.a.
Maximum payload, kg (lb)	870 (1,920)	n.a.
Maximum level speed, km/h (mph)	220 (137)	265 (164)
Cruising speed, km/h (mph):		
75% power	165 (102)	235 (146)
57% power	190 (118)	200 (124).
Speed for agricultural operations, km/h (mph)	160 (99)	–
Stalling speed (flaps up), km/h (mph)	105 (65)	n.a.
Service ceiling, m (ft)	4,000 (13,125)	6,000 (19,685)
Range at 3,000 m (9,840 ft), km (miles):		
maximum payload (with 45-minute fuel reserves)	400 (248)	300 (186)
maximum fuel	995 (618)	1,080 (671).

The registration B-0002 was reused for the Y12 turboprop transport prototype (Y11T1).

B-3801, a Y12 II demonstrator, still with a triangular ventral fin.

utility aircraft having STOL capability, a successor to the Y-5. The aircraft was intended for general transport duties, agricultural tasks (aerial sowing and top-dressing of crops, pest control), aeromedical operations, survey etc. Development took place at Harbin, with Xiong Wenjie appointed project chief. The design stage was completed in less than a year, in June 1975, the aircraft receiving the designation Y11. Prototype construction started immediately at the Harbin aircraft factory; the static test article completed its test cycle on 19th December 1975, and the maiden flight followed in short order on 30th December. Like a few other Chinese types, the Y11 was assigned a NATO codename, *Chan*.

The Y11 was a monoplane of all-metal riveted and bonded construction with a square-section fuselage having an upswept rear section, shoulder-mounted strut-braced wings of rectangular planform, conventional cantilever tail surfaces and a fixed tricycle landing gear. The wings were provided with two-section flaps and full-span leading-edge slats to ensure good short-field performance. The trapezoidal fin featured a small root fillet; the rudder and elevators were fabric-covered, unlike the ailerons. The inboard ends of the wing bracing struts were attached to small rectangular stub wings which also carried the twin-wheel main gear units; the nose unit had a single wheel. The flightdeck had car-type doors, with a cabin access door on the port side aft of the wing; in passenger/utility configuration the cabin could accommodate seven passengers.

Power was provided by two 285-hp Zhuzhou HS-6A nine-cylinder radials driving two-bladed variable-pitch propellers; the HS-6 was the Chinese-built version of the Ivchenko AI-14RF. The engines were accommodated in cylindrical nacelles fitted flush with the top of the wings and featured radial cooling air shutters at the front of the cowlings.

The prototype had a V-shaped windscreen composed of flat panes, but when the Y11 entered production a two-piece moulded windscreen was introduced. Production began on 3rd April 1977. About 50 were built; the latest known example is B-3870 (c/n 110502 – that is, Y11, Batch 05, 02nd aircraft).

The factory apron at Harbin, with Y12 IIs for Malaysia and Mongolia awaiting delivery.

The tail of a MIAT Mongolian Airlines Y12 II with a long ventral fin.

Y11 agricultural version

This version of the Y11 had a hopper installed in the cabin near the centre of gravity for dispensing seeds, fertilisers or pesticides. Depending on the type of mission, the aircraft was fitted with a tunnel-type spreader under the fuselage or spraybars under the wings; in the latter case a pump driven by a ram-air turbine was mounted on the starboard stub wing. Some drawings show the Y11 with six individual slipstream-driven atomisers mounted under the wings and on the stub wings.

In May 1981 agricultural Y11s were used with success to combat hawk moths which had infested forests in the Mudanjiang Region. As a result of their employment, more than 90% of the pests were wiped out.

Y11 geological survey version

At least one Y11 was fitted out for geological prospecting, featuring a large ring-shaped aerial on the port wingtip and a cigar-shaped sensor pod on the starboard wingtip.

Y11B utility aircraft

An improved version designated Y11B was fitted with uprated HS-6D engines giving better take-off performance and safer single-engine handling.

Y11B(I) utility aircraft

To give the Y11 more customer appeal and hopefully attract foreign orders, a version powered by 350-hp Teledyne Continental TSIO-550-B air-cooled flat-six piston engines driving three-bladed Hamilton variable-pitch propellers was brought out. Other changes included twin landing lights buried in the nosecone. Designated Y11B, the prototype (0001) took part in Airshow China '96 at Zhuhai-Sanzao in November 1996.

Harbin Y12 utility aircraft

Operational experience with the Y11 led the designers to investigate ways and means of improving the aircraft's payload/range capabilities. One obvious method was to use more powerful engines – specifically, turboprop engines. Initially the Australian company Hawker Pacific proposed re-engining the Y11 with 400-shp Allison 250-B17B turboprops; however, these were rejected in favour of 500-shp Pratt & Whitney Canada PT6A-11 turboprops driving Hartzell HC-B3TN-3B three-bladed propellers. The aircraft was provisionally designated Y11T1 (T for turboprop).

The instrument panel of the Y12 II; note the radar display in the middle.

The cabin of a Y12 II in utility configuration with tip-up seats and not even seat belts, never mind wall trim.

How's that for a change? This Y12 II is in airline configuration with three-abreast seating and passenger service units.

B-3804 (c/n 0011), an early Y-12 I geophysical survey aircraft with a characteristically cranked sensor boom.

The mission equipment operator's workstation in the cabin of a Y12 I.

Y12 I (Y11T1)

The original Y11T1 was developed specifically with geophysical survey tasks in mind, as geological prospecting (then undertaken on a large scale in China) called for a capable aerial platform. The design effort was headed by engineer Lu Kairen, and the designers took account of the US Federal Airworthiness Regulations (FAR Pt 23 and Pt 135). The design effort included a lot of special test programmes, including fire extinguishing system tests, climatic tests of the fuel system and electromagnetic compatibility tests.

The higher power of the turboprop engines allowed the airframe to be scaled up somewhat – the Y11T1 had a new and larger fuselage with a slightly more rounded cross-section and a longer, more streamlined nose. There was only one flightdeck door (on the port side); the two-piece cabin door was enlarged. The wings had slightly longer span and lacked LE slats; they incorporated a new airfoil reducing drag by 3%, and the engines were housed in much smaller and aerodynamically cleaner nacelles. The tail surfaces were enlarged, with a slight kink in the fin leading edge above the fillet and metal-skinned control surfaces, and a small triangular ventral fin was added to ensure adequate directional stability in the event of a single-engine failure. The main landing gear units were redesigned, featuring single wheels.

Three prototype airframes were built. Once the static tests had been completed in July 1982, the prototype made its first flight from Harbin on 14th July. The flight tests showed a significant improvement in performance over the Y11. By this time it was obvious that the result was, in effect, a new aircraft, and it was redesignated Y12. Some sources quoted the marketing name Turbo Panda for the aircraft.

The certification trials included geophysical survey flights over the Hebei Plateau in February 1983 and over Inner Mongolia in September 1983. Once the initial version had been jointly certificated by the Ministry of Aircraft Industry and the Ministry of Geology & Mining Industry, it entered limited production and service as the Y12 I.

B-587L, a Y12 IV prototype, shows its characteristically raked wingtips.

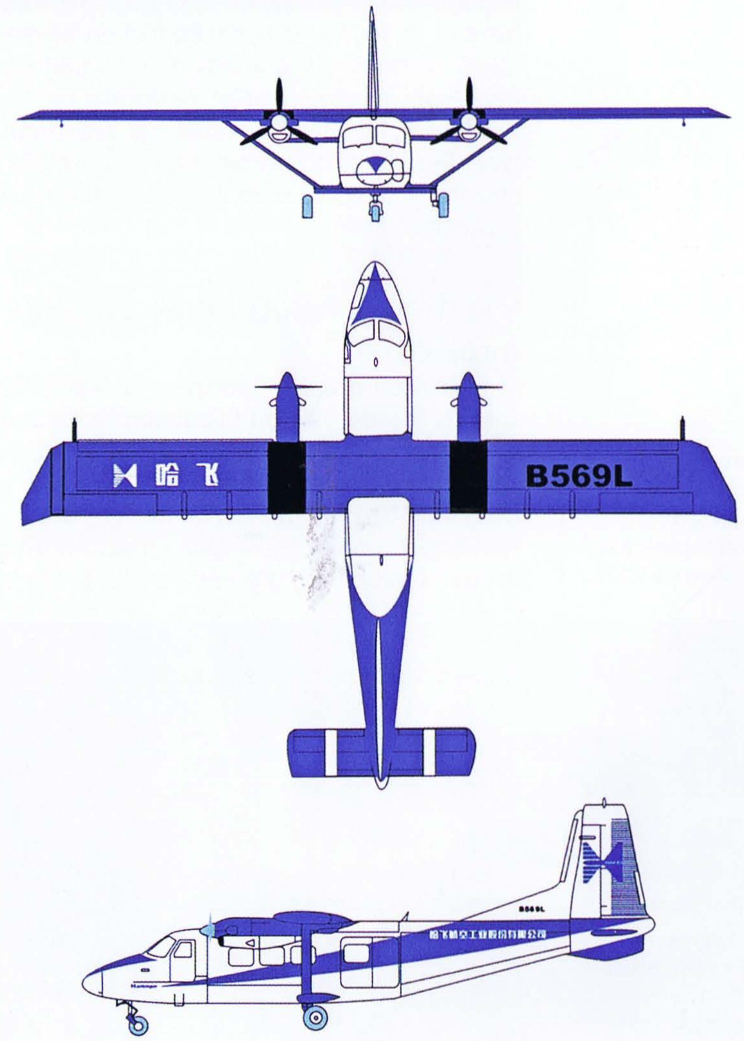
Y12 II (Y11T2) utility aircraft

An Y12 IV demonstrator bedecked with the flags of the operator nations.

A passenger/transport version of the Y12 I was brought out as the Y12 II (at the design stage it was briefly known as the Y11T2). It featured more powerful PT6A-27 engines rated at 620 shp for take-off and driving three-bladed Hartzell propellers of slightly larger diameter. Outwardly the new version differed in having a larger fin fillet and a trapezoidal ventral fin of increased area to compensate for the stronger yaw created by the more powerful engines. Other changes included the addition of emergency exits in the first pair of cabin windows, pneumatic de-icer booth on the wings and tail surfaces, and a distinctive blade aerial under the extreme nose. In airline configuration the cabin could accommodate 17 passengers; the passenger version's cabin interior and systems were modernised by HAECO in Hong Kong. The nose could house an optional Honeywell 1400C, RDS-81 or RDS-82 weather radar.

B-610L, another Y12 IV demonstrator, carries the marketing name Harbinger.

The Y12 II prototype entered flight test on 15th June 1984, and certification was achieved in December 1985. The type has achieved considerable export sales; apart from a number of Chinese civil operators, it has been supplied to the airlines of Bangladesh, Fiji, Laos, Mongolia and Nepal. Military operators include Kenya, Namibia, Peru, Sri Lanka, Tanzania and Zambia.



Y12 II photo survey version

A photo mapping version of the Y12 II was operated by several Chinese airlines, including Xinjiang General Aviation. It could be identified by the large sliding cover protecting the ventral camera windows. Two of these aircraft, B-3807 and B-3808 (c/ns 0016 and 0017), were operated by the China Maritime Survey service.

The Y12 achieved significant export sales. This is a Zambian Air Force Y-12 II.

Y12 II geophysical survey version

At least one Y12 II (B-3835) operated by China Flying Dragon Special Aviation was outfitted for geophysical survey, with podded sensor arrays mounted on the stub wings.

Y12 IV (Y12 Mk 4) utility aircraft

The next baseline version was the Y12 IV (sometimes called Y12 Mk 4); strangely enough, there was never a Y12 III. The most obvious change was the introduction of new raked wingtips giving a reduction in drag and hence an improvement in performance; the wing span was slightly increased. The prototype, B-569L, first flew on 30th August 1993 and the Y12 IV received its type certificate in September 1995.

Y12 IV Twin Panda utility aircraft (project)

In 1998 the Canadian Aerospace Group (CAG) and its Panda Aircraft Company subsidiary attempted to launch a modified Y-12 IV as the Twin Panda, the name hinting that the machine was intended as replacement for the de Havilland Canada DHC-6 Twin Otter. The Twin Panda featured more powerful PT6A-34 engines, a beefed-up landing gear, and upgraded avionics and interior. The conversion was to take place in Canada. In 2000 CAG reportedly had 35 orders for the upgrade but the project eventually folded.

A provisional model of the projected retractable-gear, pressurised Y12F.

Y12E utility aircraft

At Airshow China 2000 the Harbin Aircraft Manufacturing Co. announced the latest baseline version of the Y12. Designated Y12E, it shared the wing modification introduced on the Y12 IV but was powered by PT6A-135A engines derated to 620 shp and driving four-bladed Hartzell HC-D4N-3N/D9511FK constant-speed reversible-pitch metal propellers. The airframe featured structural reinforcements and improved interior soundproofing, and the avionics suite was updated.

The Y12E prototype (B-610L) entered flight test in August 2001. A national type certificate was issued on 26th February 2002; FAA certification followed on 2nd August 2006. Sichuan Airlines became the launch customer.

Y12AEW airborne early warning aircraft (project)

In 2004 the Harbin Aircraft Industry Group announced the development of an airborne early warning and maritime surveillance version designated Y12AEW. The aircraft would have been similar to the de Havilland Canada DHC-6 Twin Otter 300MR, featuring a bulged nose housing a Racal Skymaster radar. The Y12AEW was never built.

Y12F utility aircraft (project)

The Harbin Aircraft Manufacturing Co. undertook preliminary design studies of a pressurised version with a retractable landing gear. This aircraft is designated Y12F.

Y12 specifications

	Y12 I (Y11T1)	Y12 II	Y12 IV	Y12E
Length overall	14.86 m (48 ft 9 in)	14.86 m (48 ft 9 in)	14.86 m (48 ft 9 in)	14.86 m (48 ft 9 in)
Wing span	17.235 m (56 ft 6½ in)	17.235 m (56 ft 6½ in)	19.2 m (63 ft 0 in)	19.2 m (63 ft 0 in)
Height on ground	5.275 m (17 ft 3¾ in)	5.675 m (18 ft 7½ in)	5.675 m (18 ft 7½ in)	5.675 m (18 ft 7½ in)
Wing area, m² (sq ft)	34.27 (368.88)	34.27 (368.88)	36.90 (397.2)	36.90 (397.2)
Wing aspect ratio	8.67	8.67	9.6	9.6
Elevator span	5.265 m (17 ft 3¼ in)	5.365 m (17 ft 7¼ in)	5.365 m (17 ft 7¼ in)	5.365 m (17 ft 7¼ in)
Vertical tail area, m² (sq ft)	5.064 (54.51)	5.58 (60.0)	5.58 (60.0)	5.58 (60.0)
Horizontal tail area, m² (sq ft)	7.024 (75.61)	7.16 (76.99)	7.16 (76.99)	7.16 (76.99)
Wheel track	3.6 m (11 ft 9¾ in)	3.61 m (11 ft 10¼ in)	3.61 m (11 ft 10¼ in)	3.61 m (11 ft 10¼ in)
Wheelbase	4.572 m (15 ft 0 in)	4.7 m (15 ft 5 in)	4.7 m (15 ft 5 in)	4.7 m (15 ft 5 in)
Propeller diameter	2.36 m (7 ft 9 in)	2.49 m (8 ft 2 in)	2.49 m (8 ft 2 in)	2.44 m (8 ft 0 in)
Maximum zero-fuel weight, kg (lb)	n.a.	4,900 (10,800)	5,188 (11,438)	5,188 (11,438)
Maximum take-off weight, kg (lb)	5,500 (12,125)	5,300 (11,684)	5,670 (12,500)	5,670 (12,500)
Maximum fuel load, kg (lb)	1,200 (2,645)	1,230 (2,712)	1,230 (2,712)	1,230 (2,712)
Maximum payload, kg (lb)	1,700 (3,750)	1,700 (3,750)	1,984 (4,370)	1,984 (4,370)
Maximum level speed, km/h (mph)	282 (175)	328 (204)	300 (186)	300 (186)
Economical cruising speed, km/h (mph)	n.a.	250 (155)	260 (162)	270 (167)
Max rate of climb at sea level, m/sec (ft/min):				
normal operation	n.a.	8.1 (1,594)	7.8 (1,535)	7.8 (1,535)
one engine inoperative	n.a.	1.4 (275)	1.5 (295)	1.45 (285)
Service ceiling, m (ft):				
normal operation	7,000 (22,965)	7,000 (22,965)	7,000 (22,965)	7,000 (22,965)
one engine inoperative	n.a.	3,000 (9,840)	n.a.	4,145 (13,600)
Take-off run with 15° flap, m (ft):				
normal	n.a.	340 (1,115)	370 (1,215)	450 (1,480)
STOL	220 (720)	230 (755)	n.a.	360 (1,180)
Take-off distance to 15 m (50 ft), m (ft)	547 (1,795)	391 (1,283)	490 (1,607)	n.a.
Landing run with 20° flap, m (ft)				
with braking and propeller reversal	210 (690)	200 (660)	n.a.	n.a.
with brakes only	n.a.	340 (1,120)	340 (1,120)	330 (1,085)
Landing distance from 15 m (STOL, with braking and propeller reversal), m (ft)	n.a.	370 (1,215)	370 (1,215)	320 (1,050)
Range at 3,000 m (9,840 ft), km (miles):				
maximum payload (with 45-minute fuel reserves)	410 (255)*	410 (255)*	n.a.	n.a.
maximum fuel (no reserves)	1,410 (876)	1,340 (832)	1,300 (807)	1,340 (832) †

* with a 1,445-kg (3,185-lb) payload † with 45-minute fuel reserves

Y12G cargo aircraft

Another version under consideration is the Y12G dedicated freighter with a side cargo door and a windowless cabin accommodating three LD3 standard airfreight containers. The design work was undertaken in 2002-03.

McDonnell Douglas (Shanghai) MD-82/MD-83/MD-90 airliners

In April 1985, two years after the demise of the Y10 programme, the Shanghai Aircraft Industry Co. (SAIC) signed an agreement with the McDonnell Douglas Aircraft Co. (now taken over by Boeing Aircraft). The deal envis-

An MD-82 in the assembly shop of the Shanghai Aircraft Manufacturing Factory.

aged the assembly of 25 MD-82 (DC-9-82) short/medium-haul airliners from CKD kits; the aircraft were to be powered by Pratt & Whitney JT-8D-217A turbofans and completed in a 147-seat all-economy layout. The first delivery was to take place in the second half of 1987 and the final delivery in 1991.

The first Shanghai-built example, B-2106 (c/n 49415, McDD fuselage number 1260, SAIC set number 1) took to the air on 2nd July 1987 and was delivered to Shenyang-based China Eastern Airlines at the end of the month. The Chinese-built MD-82s were also delivered to China Northern Airlines; later, four of the initial 25 aircraft were resold to the US carrier Spirit Airlines and another five to the charter airline Spanair of Spain.

A model of the Y9 transport in its current project configuration.

Subsequently the agreement was amended, increasing the planned production total to 53. The first five machines covered by this additional agreement were likewise MD-82s while the rest were to be completed as MD-83s. Eventually, however, only the MD-82s and the first five MD-83s were completed, Shanghai production ending at 35 machines. Incidentally, the five MD-83s (set Nos. 29-33) were delivered to the US carrier Trans World Airlines.

The last Shanghai-built example, B-2145 (c/n 49853, f/n 1981, set No. 35) was completed as the sole MD-82T cargo aircraft for China Northern Airlines.

Later, under a new agreement, SAIC built two examples of the re-engined MD-90-30 derivative powered by IAE V25252-D5 turbofans – B-2100 and B-2103 (c/ns 60001 and 60002, f/ns 4001 and 4002, set Nos. 1 and 2). The two aircraft were delivered to China Southern Airlines in November 2004.

Shaanxi Y9 military transport (project)

In 2001 the Shaanxi division of AVIC II began development of a new-generation medium transport aircraft to meet a PLAAF requirement for an advanced successor to the ageing Y8. The aim of the project was to create a multi-purpose transport aircraft that approaches or in some aspects exceeds the performance of the Lockheed Martin C-130J Super Hercules. Originally known as the Y8F-800 and then as the Y8X (confusingly enough – see Y8MPA above), the project was unveiled under this tentative designation at Airshow China 2002 in Zhuhai. Actually, however, the aircraft was sufficiently different to qualify as a separate design; hence at the September 2005 International Aviation Expo in Beijing SAIC re-unveiled the aircraft under the new designation Y9. It is said to be comparable to the Lockheed Martin C-130J Super Hercules transport in general performance. The Antonov ASTC is believed to have assisted with the Y9's development.

The aircraft features a much-modified fuselage, all-new wings and tail surfaces and a modified landing gear (again, the main units have four wheels each). The fuselage is similar

PT-SGF, the first Embraer ERJ-145LI assembled by Harbin Embraer Aviation Industries.

to that of the Y8F-600 as regards the shape of the nose and the forward location of the entry door, but the shape of the rear fuselage is different. The wings have constant anhedral from the roots, lacking the kink at the inner/outer wing joints characteristic of the An-12 (Y8). The tail surfaces have slight sweepback and the vertical tail lacks the large dorsal fin of the preceding versions, featuring only a small root fillet.

The original intention was to use Western turboprops in the 6,500-ehp class. Now, however, the Y9 is due to be powered by improved WJ-6C turboprops driving indigenous JL-4 six-blade propellers made of composite materials. The internal fuel load is 23 tons (50,700 lb).

The aircraft will have a four-man 'glass cockpit' and a more capacious cargo cabin equipped with efficient cargo handling devices for fast loading/unloading. The cargo cabin is 16.2 m (53 ft $1\frac{51}{64}$ in) long, 3.2 m (10 ft 6 in) wide and 2.35 m (7 ft $8\frac{33}{64}$ in) high. The maximum payload is 20 tons (44,090 lb); payload options include wheeled or tracked vehicles, helicopters, and cargo containers/pallets. The latter comprise thirteen 1-metre (3 ft 3 in) size pallets, or three 4-metre (13 ft $1\frac{1}{2}$ in) size pallets, or one 6-metre (19 ft 8 in) pallet. The Y9 will be able to paradrop single loads grossing at up to 8.2 tons (18,080 lb), or multiple loads totalling up to 13.2 tons (29,100 lb), or 98 paratroopers with full kit. In medevac configuration it will be able to carry 72 stretcher cases or 98 walking wounded, plus three medical attendants.

With a maximum take-off weight of 65 tons (143,300 lb), the aircraft is to have a maximum speed of 650 km/h (403 mph) and a cruising speed of 550 km/h (341 mph); the service ceiling is 10,100 m (33,140 ft) and the cruise altitude 8,000 m (26,250 ft). The required runway length is 1,350 m (4,430 ft).

Y16 airliner (project)

The Y16 was to be a Chinese licence-built version of the Boeing 737-400. Eventually the plans to build the type were abandoned.

HEAI Embraer ERJ-145 airliner

On 2nd December 2002 the Harbin Aircraft Industry Group and Hafei Aircraft Industries signed a contract with the Brazilian aircraft manufacturer Embraer, setting up a joint venture called Harbin Embraer Aircraft Industry Co Ltd. (HEAI). The purpose of the venture was co-production of the ERJ-145 twin-turbofan regional airliner. Embraer held a 51% stake,

A model of the ARJ21-700B business jet at the 2007 Paris Air Show.

HAIG and HAI holding 24.5% each. The Brazilian company invested US$ 25 million to build a new 24,000 m^2 (258,330 sq ft) production facility at Harbin where the ERJ-145 (and possibly the 'destretched' ERJ-135/ERJ-140 as well) would be assembled from

The ARJ21-700 prototype in the assembly shop at Shanghai, with the horizontal tail and engines yet to be fitted.

CKD kits. Initially, Harbin contributed by manufacturing fuselage frames only but was to master production of progressively more airframe components. The planned capacity of the plant was 24 aircraft per year.

The HEAI plant was commissioned in August 2003. Wearing the test registration PT-SGF, the first locally assembled ERJ-145LI (c/n 145701; LI means 'licence-built') took to the air on 16th December that year. (The Chinese-built examples received construction numbers in the general Embraer system – and, rather surprisingly, they were all test-flown with Brazilian registrations in the PT-S** series assigned to Embraer.) China Southern Airlines was the launch customer, placing an order for six aircraft which were delivered between June 2004 and January 2005. The second customer was China Eastern Airlines, which ordered five ERJ-145s in March 2005, with deliveries starting in August.

The still-incomplete ARJ21-700 comes out of the assembly shop.

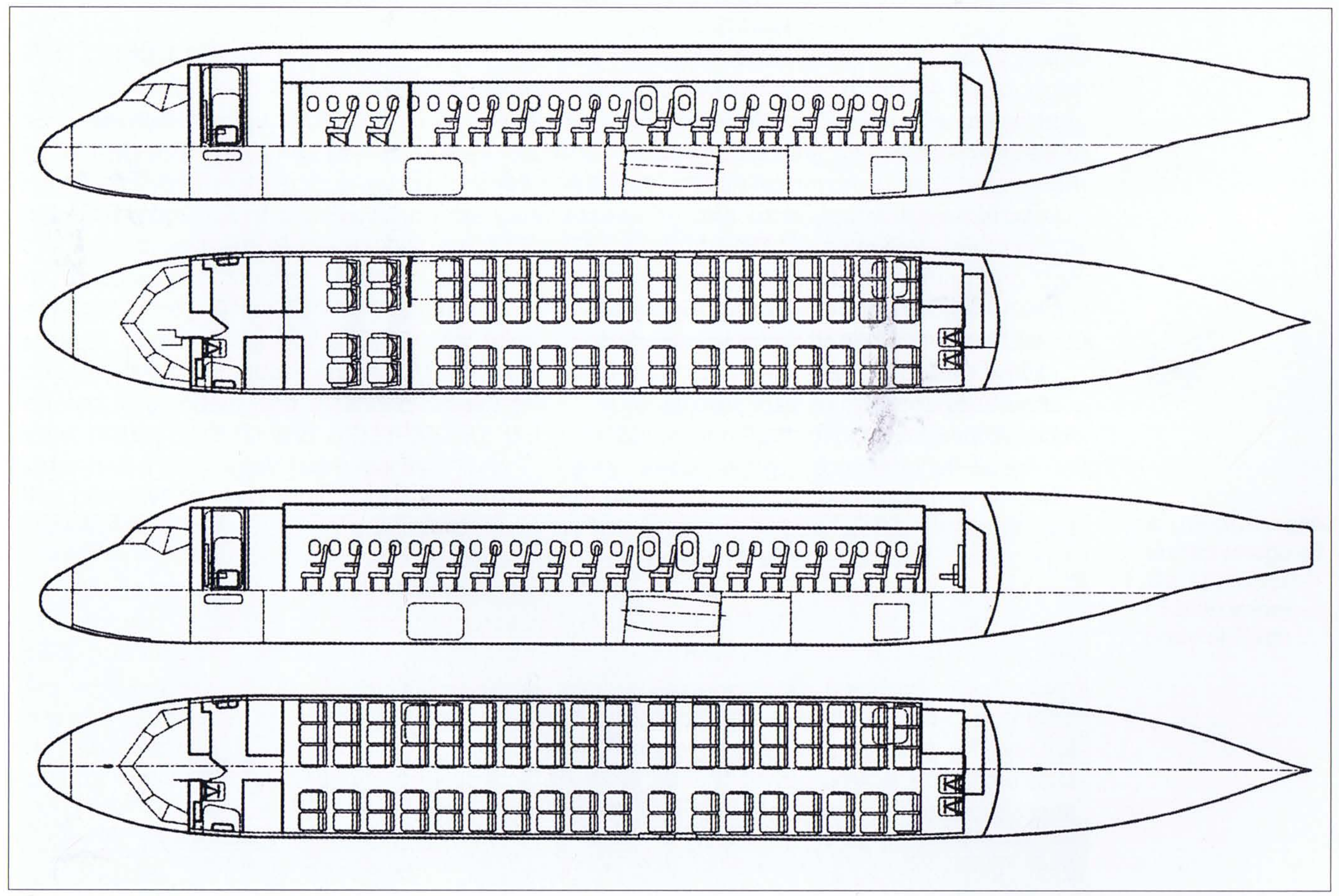
ACAC ARJ21 Xiangfeng

In 1998 six Chinese companies – the Chengdu Aircraft Co., the Shanghai Aircraft Research Institute (SARI), the Shanghai Aircraft Industry Co., the Shenyang Aircraft Co., the Xian Aircraft Design & Research Institute (XADRI) and the Xian Aircraft Co. – teamed up to study the prospects of developing a new regional jet (NRJ) – China's first aircraft of the kind. The NRJ was officially launched by AVIC I on 7th November 2000 as US$ 700 million programme. Two versions were proposed – the NRJ-58 and the NRJ-76, the figures reflecting the seating capacity. The larger model was rebranded ARJ21 ('Advanced Regional Jet for the 21st Century') in 2001 and approved by China's State Council in 2002 as part of the 10th Five-Year Economic Plan. That year a government-controlled consortium known as the AVIC I Commercial Aircraft Company (ACAC) was formed to run the project. The ARJ21 was to compete against such regional airliners as the Bombardier CRJ-700/900/1000 series, the Embraer 170/190 series, the Fokker 100, the Antonov An-148 and the Sukhoi RRJ (Russian Regional Jet; now renamed Superjet 100).

SARI and XADRI were responsible for the design. Mr. Wu Guanghui was the ARJ21's general designer, assisted by Mr. Zhou Jisheng as deputy general designer, with Ms. Jiang Liping as general engineer.

The ARJ21 shared the rear-engine, T-tail layout of the McDonnell Douglas MD-80/MD-90 twinjet series. The basic fuselage design was borrowed from the latter aircraft, having the same double-bubble fuselage cross-section and nose profile (albeit there was no ventral airstair door at the rear). The tail unit design was also borrowed wholesale. This was no matter of chance: as mentioned above, SAIC (which was selected as the main contractor to build the airliner) had previously assembled 35 MD-82s under licence and still had the jigs and tooling left over from this aircraft, and these were to be used for building the ARJ21. The fuselage was mated with all-new supercritical wings whose development had been subcontracted out to the Antonov ASTC in the Ukraine. The high aspect ratio wings were swept back 25° at quarter-chord (versus 24°30′ on the MD-80/MD-90), with 3°

The first-class and economy class cabins of the ARJ21.



The 78-seat mixed-class and 90-seat all-economy cabin layouts of the ARJ21-700.

Basic specifications of the ARJ21 family

	ARJ21-700	ARJ21-900	ARJ21F	ARJ21B
Length overall	33.464 m (109 ft $9\frac{31}{64}$ in)	36.359 m (119 ft $3\frac{29}{64}$ in)	33.464 m (109 ft $9\frac{31}{64}$ in)	33.464 m (109 ft $9\frac{31}{64}$ in)
Wing span	27.288 m (89 ft $6\frac{21}{64}$ in)	27.288 m (89 ft $6\frac{21}{64}$ in)	27.288 m (89 ft $6\frac{21}{64}$ in)	27.288 m (89 ft $6\frac{21}{64}$ in)
Horizontal tail span	10.496 m (34 ft $3\frac{31}{32}$ in)	10.496 m (34 ft $3\frac{31}{32}$ in)	10.496 m (34 ft $3\frac{31}{32}$ in)	10.496 m (34 ft $3\frac{31}{32}$ in)
Height on ground	8.442 m (27 ft $8\frac{23}{64}$ in)	8.441 m (27 ft $8\frac{23}{64}$ in)	8.442 m (27 ft $8\frac{23}{64}$ in)	8.442 m (27 ft $8\frac{23}{64}$ in)
Wing area, m^2 (sq ft)	79.86 (859.61)	79.86 (859.61)	79.86 (859.61)	79.86 (859.61)
Landing gear track	4.68 m (15 ft $4\frac{1}{4}$ in)	4.68 m (15 ft $4\frac{1}{4}$ in)	4.68 m (15 ft $4\frac{1}{4}$ in)	4.68 m (15 ft $4\frac{1}{4}$ in)
Landing gear wheelbase	14.878 m (48 ft $9\frac{3}{4}$ in)	16.802 m (55 ft $1\frac{1}{2}$ in)	14.878 m (48 ft $9\frac{3}{4}$ in)	14.878 m (48 ft $9\frac{3}{4}$ in)
Engine rating, kgp (lbst)	2 x 6,950 (2 x 15,330)	2 x 7,740 (2 x 17,060)	2 x 6,950 (2 x 15,330)	2 x 6,950 (2 x 15,330)
Operating empty weight, kg (lb)	24,955 (55,020)	26,270/26,770 (57,915/59,020) †	26,355 (58,100)	25,755 (56,780)
Maximum fuel load, kg (lb)	10,386/10,886 (22,897/23,999) *	10,386/10,886 (22,897/23,999) †	10,386 (22,897) †	16,386 (36,125)
Maximum take-off weight, kg (lb)	40,500/43,500 (89,300/95,900)*	43,616/47,182) (96,157/104,018) †	43,500 (95,900)	43,500 (95,900)
Maximum landing weight, kg (lb)	37,665/40,455 (83,037/89,188) *	40,563/43,879 (89,426/96,737) †	40,455 (89,190)	40,455 (89,190)
Maximum payload, kg (lb)	8,935 (19,698)	11,246 (24,793)	10,050/10,150 (22,160/22,380) #	3,000 (6,610)
Cruising speed, km/h (mph)	829 (515) Mach 0.78	Mach 0.78-0.80	Mach 0.78-0.80	Mach 0.80
Range, km (miles)	2,200/3,700 (1,400/2,300)*	2,225/3,334 (1,380/2,070) †	3,334 (2,070) §	6,112 (3,796)
Service ceiling, m (ft)	11,900 (39,040)	11,900 (39,040)	11,900 (39,040)	11,900 (39,040)
Take-off field length, m (ft)	1,700/1,900 (5,580/6,230)*	1,750/1,950 (5,740/6,400) †	1,900 (6,230)	1,900 (6,230)
Landing field length, m (ft) ‡	1,550/1,650 (5,085/5,410)*	1,600/1,700 (5,250/5,580) †	1,650m/5,413ft	1,650m/5,413ft

* ARJ21-700STD/ARJ21-700ER with standard passenger payload

† ARJ21-900STD/ARJ21-900ER with standard passenger payload

‡ Sea level, ISA, maximum weight

Pallets/LD7 containers

§ With 85% main hold payload

dihedral, and equipped with winglets, and the trailing edge was kinked, not straight. The wings had three-section leading-edge slats and two-section flaps.

The powerplant consisted of two General Electric CF34-10A turbofans with cascade-type thrust reversers on the bypass flow mounted in the same way as on the precursor (in nacelles flanking the rear fuselage). The choice of the CF34 to power the ARJ21 was announced on 5th November 2002.

The ARJ21 featured fly-by-wire controls with electro-hydraulic and electro-mechanical actuators, had a flight crew of two and with five colour displays. The avionics suite was integrated via a data bus.

Shanghai Airlines of China became the launch customer in 2003. Initially the first flight was optimistically targeted for 2005, with certification to be achieved in mid-2007 and first deliveries at the end of the year. However, development problems caused the schedule to slip and prototype construction did not begin until June 2006. The first prototype ARJ21-700 was ceremonially rolled out on 21st December 2007; the popular name

Xiangfeng (Flying Phoenix) was also unveiled on that occasion. That same day the aircraft won its biggest order to date – Xi'an-based Kunpeng Airlines, a regional joint venture launched by Shenzhen Airlines and Mesa Air Group (USA), ordered 100 aircraft. Until then the ARJ21's order book had stood at 71 domestic orders.

The maiden flight was slated for March 2008. The first ARJ21 is expected to be delivered to Shandong Airlines in September 2009.

ARJ21-700 airliner

Four versions were envisaged. The baseline ARJ21-700 had a short fuselage seating 70 passengers in a mixed-class layout or 85 (some sources say 78 and 90 respectively) in a five-abreast all-economy layout, with two large (Type I) emergency exits aft of the wings. The engines were rated at 6,950 kgp (15,330 lbst). The customers were offered a choice of standard (ARJ21-700STD) and extended-range (ARJ21-700ER) versions. The former variety was mainly intended for feeder air routes in 'hub-and-spoke' air transport systems; the ER version was suitable for 'thin' point-to-point air routes.

ARJ21-900 airliner

A version designated ARJ21-900 seated 98 in a mixed-class configuration or 105 in an all-economy configuration. The fuselage was stretched 2.895 m (9 ft $5\frac{31}{32}$ in) by inserting 'plugs' fore and aft of the wings and the Type I emergency exits aft of the wings gave place to two pairs of smaller (Type III) overwing emergency exits. The CF34-10A engines were uprated to 7,740 kgp (17,060 lbst) for take-off. Like the basic model, the ARJ21-900 was offered in standard and extended-range versions (ARJ21-900STD and ARJ21-900ER); the latter had a 5% higher fuel capacity.

ARJ21F freighter

A freighter version of the ARJ21-700 was designated ARJ21F, featuring a windowless cabin with an upward-opening cargo door to port. The cabin had a capacity of 111.286 m^3 (3,930 cu ft), accommodating five LD7 containers unit weight of 2,030kg (4,475 lb) or PIP ('package-in-package') pallets with a unit weight of 2,010kg (4,430 lb); the maximum payload was 10,150 kg (22,380 lb).

ARJ21B executive jet

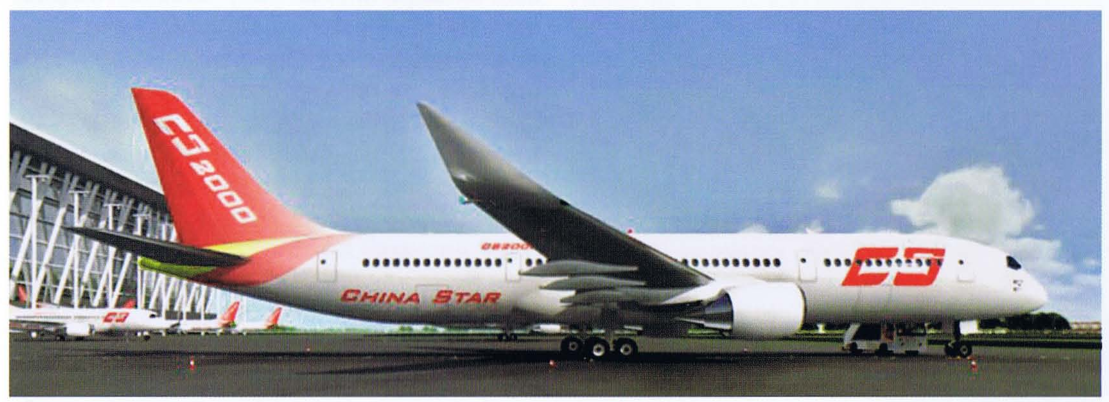
Finally, a business jet version of the ARJ21-700 was also offered as the ARJ21B. A typical configuration would cater for 20 passengers.

The manufacturing responsibilities were distributed as follows between the members of the ACAC consortium. XAC would build the wings and fuselage, except for the forward fuselage section, which would be supplied by CAC. SAIC would manufacture the complete tail unit, while SAC was responsible for final assembly.

Guangdong Changsheng China Star CS2000 airliner (project)

On 5th December 2006 a company called Guangdong Changsheng, or the Guangdong Prosperous Airplane Design Company Ltd., was established as the first privately operated aircraft design enterprise in China, with research and development facilities in Shanghai. In 2007 the company announced its plans to design and build nothing less than two families of advanced twin-turbofan airliners. One of them is the China Star CS2000 widebody long-haul airliner.

The aircraft has a classic layout with a circular-section fuselage, low-mounted moderately swept wings, conventional swept tail



A computer-generated image of the China Star CS2000 widebody airliner.

surfaces, two large high-bypass turbofan engines in underwing nacelles and a tricycle landing gear with a twin-wheel forward-retracting nose unit and four-wheel main bogies retracting inwards. According to reports, the share of composite materials in the structure is to reach 25%.

Computer-generated images and photos of a display model circulated on the Internet show the aircraft to have an extraordinary likeness to the as-yet unflown Boeing 787 Dreamliner. This applies to the shape of the flightdeck glazing, the curved 'fish-tail' contour of the fin and the raked wingtips. Actually, unlike the 787, the wingtips are gently curved upwards to form winglets.

Three versions differing in fuselage length are envisaged – the CS2000-100, -200 and -300. The seating capacity ranges from 200 to 300 passengers.

An artist's impression of the China Star CS2010-100/-200/-300 narrowbody and CS2000-100/-200/-300 widebody airliner families.

At this point the CS2000 certainly appears to be a pie-in-the-sky project. Experts rightly point out that if even an aerospace giant like Boeing has trouble with its highly innovative 787, what can we expect from a fledgling company with a small design staff and little experience in the field? (It has been suggested that some of the people designing the CS2000 were involved with the Y10; but if this is true, then they must be of a very advanced age!)

Guangdong Changsheng China Star CS2010 airliner (project)

The other project offered by the Guangdong Prosperous Airplane Design Company is the 150- to 200-seat CS2010 series. This is a narrowbody airliner looking like a scaled-down CS2000 with twin-wheel main gear units – an aircraft in the same class as the Boeing 737NG and the Airbus Industrie A320/A321. Again, the aircraft is offered in three versions differing in fuselage length – the CS2010-100, -200 and -300. And again, the chances of the project materialising are rather slim.

Xian WJ airliner/transport (project)

At Airshow China-2004 in November 2004 the Xian Aircraft Co. unveiled a fairly crude model of a prospective twin-turbofan aircraft. By the looks of it the aircraft is a regional airliner and/or tactical transport in the same class as the Fairchild Dornier 328JET and the Antonov An-148 – that is, the 50-passenger/20-tonne (44,090-lb) gross weight size class – a prospective short/medium-range successor to the Y7 family. However, one account described it as 'destined for training of crews and for experimentations'; this may account for the project designation which has been reported as WJ (Woshan Jiaolianji – turbofan-powered trainer).

The WJ is similar in layout to the An-148, featuring a circular-section fuselage, shoulder-mounted moderately swept wings, a swept T-tail and two unspecified turbofans in underwing nacelles. All three landing gear units have twin wheels, the main units retracting inwards, with lateral fairings on the lower centre fuselage over actuation gear. No target performance figures have been released.

7 Special Mission Aircraft

B-4138, the first Tu-154M/D ELINT aircraft, is shown here in its definitive guise.

This chapter deals with special mission versions of imported aircraft that were developed in China. The authors have chosen not to separate the special mission versions of Chinese-built transports, bombers and so on from the baseline models described in the appropriate chapters.

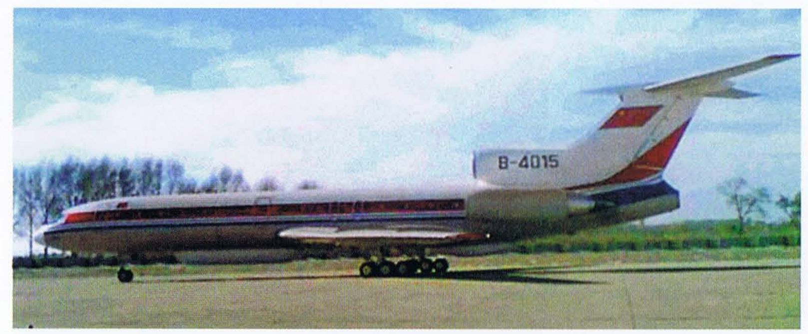
Tupolev Tu-154M/D ELINT aircraft

Starting in 1988, China United Airlines (CUA), the PLAAF's commercial division, acquired a total of 16 new and second-hand Tupolev Tu-154M three-turbofan medium-haul airliners (NATO reporting name *Careless*). The aircraft ostensibly wore civil registrations and the livery of the CAAC airline (Civil Aviation Administration of China), operating from Nanyuan airbase near Beijing. Initially their duties were confined to carrying military top brass and high-ranking statesmen. Starting in 1992, however, one of CUA's Tu-154Ms (B-4002, c/n 85A712) was converted into an electronic intelligence (ELINT) aircraft known as the Tu-154M/D; the conversion was completed in 1995 and the aircraft was reregistered B-4138. As with the HD-5 and HD-6, the D suffix stood for *Dian* and denoted 'electronic warfare aircraft'. Originally the Tu-154M/D was perceived as an airborne command post; it took a while for its true mission to be clarified.

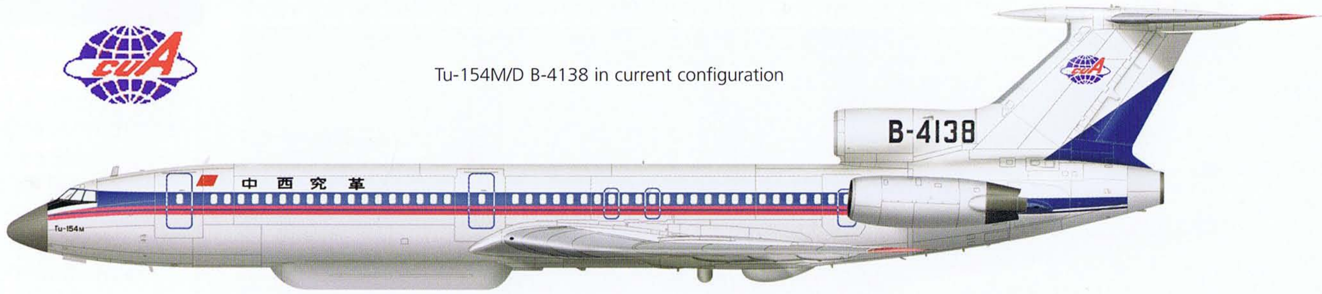
Initially B-4138 featured a large teardrop radome under the forward fuselage (halfway between the nose landing gear unit and the wings), a smaller teardrop radome immediately ahead of the wing leading edge and a second large teardrop radome under the wing centre section. Two small hemispherical dielectric blisters were fitted in line with the wing trailing edge and the end of the wing/fuselage fairing, and two larger hemispherical dielectric blisters were positioned in line with the pylons of the Nos. 1 and 3 engines.

The mission equipment of the Tu-154M/D is thought to be the KZ800 computerised ELINT system developed by Southwest Institute of Electronic Engineering (SWIEE), which is part of the China Electronic Technology Group. The mission equipment was used to detect, identify and pinpoint hostile land-based or shipborne radar emitters within the frequency range of 1.0-18.0 GHz, and then

B-4015, another Tu-154M/D. Unlike B-4138, it does not wear CUA titles and logo.



Tu-154M/D B-4015 in early configuration



Tu-154M/D B-4138 in current configuration

measure and analyse the intercepted signal parameters.

By late 2000 the first Tu-154M/D had been refitted completely, with radical changes in its appearance. The forward triplet of radomes gave place to a large ventral canoe fairing with two dielectric sections reportedly housing a synthetic aperture radar (SAR) similar to that of the USAF's Boeing E-8 Joint Surveillance/Target Attack Radar System (JSTARS). The rear quartet of blisters was likewise removed and replaced by a small 'thimble' radome in line with the wing trailing edge and a large teardrop radome immediately aft of it. A strake aerial was added on the underside of the nose just aft of the radome, and two additional blade aerials appeared immediately ahead of the nosewheel well and on top of the fuselage in line with the first pair of cabin windows. The aircraft now wore full CUA colours.

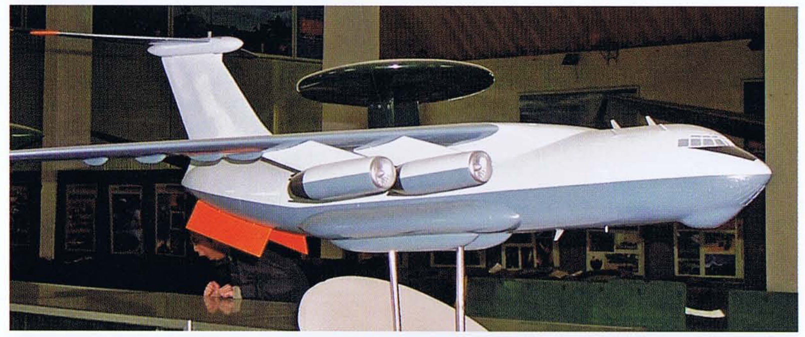
These views show B-4138 as originally flown with an array of smaller ventral radomes.

Detailed information regarding the SAR system fitted to the Tu-154M/D is not available due to its high sensitivity, as the aircraft is believed to be the most sophisticated airborne ELINT/surveillance platform in service with the PLAAF. However, China is known to have been active in the field of SAR research since the late 1970s, with the first operational airborne X-band mono-polarisation SAR system introduced in 1981 by the Electronics Institute of the Chinese Academy of Science. The multi-polarisation SAR system was introduced in the early 1990s for flood monitoring. The first real-time airborne SAR system was introduced in 1994.

In a war scenario, the Tu-154M/D could be used to detect and track enemy ground movements in both forward and rear areas in any weather conditions without entering enemy airspace, transmitting radar imagery and other information to ground stations via data link. This would help the PLA to manage joint military operations and find priority targets for air and missile strikes.

Later, the PLAAF ordered the conversion of three more Tu-154Ms to this late Tu-154M/D configuration. These are B-4015 (c/n 90A856), B-4024 (c/n 88A789) and B-4029 (c/n 93A950); the latter was the first to be spotted in 2006. They wear basic CUA colours without titles or logos.

The Tu-154M is powered by three 10,500-kgp (23,150-lbst) Aviadvigatel' (Solov'yov) D-30KP-154 II turbofans. It is 48.0 m (157 ft 5$\frac{49}{64}$ in) long and 11.4 m (37 ft 4$\frac{13}{16}$ in) high, with a wing span of 37.55 m (123 ft 2$\frac{11}{32}$ in). The maximum take-off weight and the maximum landing weight are 100,000 kg (220,460 lb) and 82,000 kg (180,780 lb) respectively. The service ceiling is 12,000 m (39,370 ft). The basic airliner's maximum cruising speed is 935 km/h (587 mph) but it is not known how much the Tu-154M/D's excrescences take off the aircraft's maximum speed.



A fairly crude model of the KJ-2000 AWACS with outsize stabilising strakes.

Xian KJ-2000 AWACS aircraft

This aircraft has a rather tortuous history. In 1994, in parallel with its efforts to create an indigenous AWACS, China started negotiations with Russia and Western avionics manufacturers on the conversion of the Il'yushin IL-76MD (NATO reporting name *Candid-B*) into an AWACS platform. The UK avionics house GEC-Marconi offered the Argus 2000 mechanically-scanned airborne early warning radar system fitted earlier to the unsuccessful British Aerospace Nimrod AEW Mk. 1, but Elta Electronics of Israel won the order by offering a more sophisticated mission avionics suite built around the EL/M2075 Phalcon phased-array radar. Interestingly, China was adamant that it would only buy the Phalcon system if it was installed on the IL-76.

Originally the radar arrays were to be housed in the nose, the tailcone and on the forward fuselage sides in similar fashion to IAI's Boeing 707-320 AWACS equipped with the Phalcon radar. However, this was soon abandoned in favour of a conventionally mounted rotodome. The Il'yushin/Beriyev A-50 (NATO reporting name *Mainstay*) was chosen

'762 Black', the KJ-2000 prototype converted from an A-50U AWACS, on finals to CFTE's Yanliang base.

'30074 Red', a freshly converted KJ-2000. Note the SATCOM blister ahead of the wings

A KJ-2000 in full PLAAF markings sits in a huge shelter protecting it from US surveillance satellites.

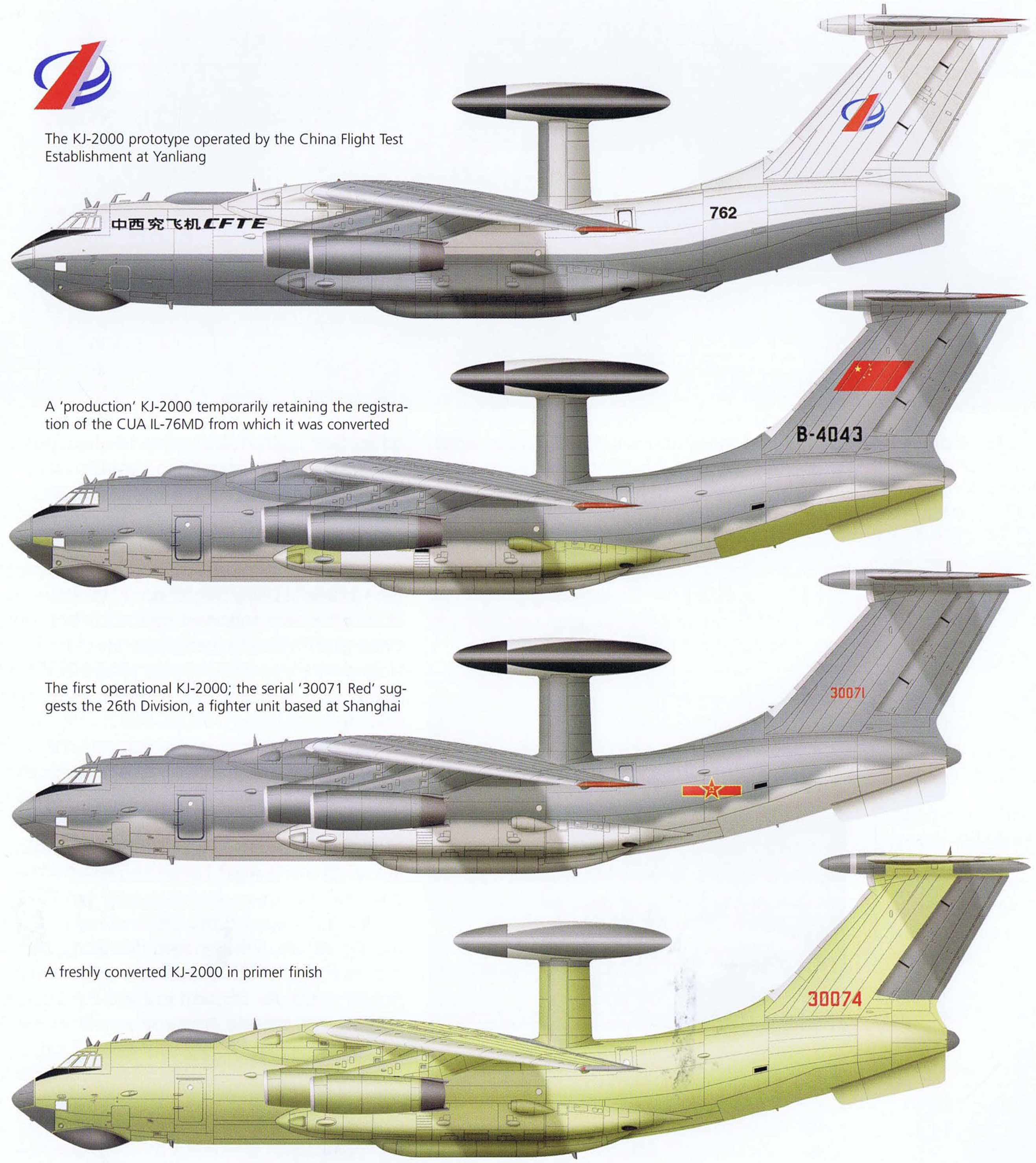
as the most suitable base aircraft. The original Russian Shmel'-U radar was replaced by the Phalcon and the resulting aircraft was designated A-50I or 'aircraft AI', the I standing for *izrail'skoye [oboroodovaniye]* – Israeli equipment.

It took a lot of persuasion before the Russian government gave the go-ahead for the A-50 to be exported. Some sources suggest the Russian government was reluctant to allow a *Mainstay* to be sold to IAI for conversion because it had hoped to sell the A-50 to China in 'as-was' condition.

As distinct from the basic A-50, the A-50I's rotodome belied its name because it was, in fact, fixed and the radar beams were scanned electronically. The 'rotodome' was slightly larger in diameter and mounted on new pylons having constant chord (instead of tapered ones). There were three dielectric portions instead of two; they enclosed three antenna arrays, each covering a sector of 120°. The triangular horizontal strakes on the main gear fairings characteristic of the standard A-50 were deleted; instead, the A-50I had twin splayed trapezoidal ventral fins under the rear fuselage. The large cooling air intake at the

Unlike the prototype, 'production' KJ-2000s retain the port entry door revealing their origins from stock IL-76MDs.

A quasi-civil KJ-2000 (note the Chinese flag on the tail) on final approach. The rotodome design is clearly visible here.



The KJ-2000 prototype operated by the China Flight Test Establishment at Yanliang

A 'production' KJ-2000 temporarily retaining the registration of the CUA IL-76MD from which it was converted

The first operational KJ-2000; the serial '30071 Red' suggests the 26th Division, a fighter unit based at Shanghai

A freshly converted KJ-2000 in primer finish

base of the fin, another trademark feature of the standard *Mainstay*, was also omitted, and some aerials and dielectric panels were also deleted or altered.

Wearing the test and delivery registration RA-78740, the A-50I prototype (ex Russian Air Force A-50U '44 Red', c/n 0093486579, f/n 6505) was delivered to Tel Aviv for conversion on 25th October 1999 after several months of delays. The cost of outfitting a single aircraft to A-50I standard (not counting the aircraft itself) was estimated at some US$ 250 million. However, despite being on reasonably good terms with mainland China, the USA saw the deal as a threat to Taiwan and began putting pressure on Israel, trying to stop the deal from coming through. Israel put on a show of defiance at first (the then Prime Minister Ehud Barak said IAI will fulfil its contract obligations no matter what) but gave in when the USA

B-4043, another former China United Airlines IL-76MD freshly converted to a KJ-2000. Parts of the airframe are still unpainted.

threatened to withdraw US$ 20 billion worth of military aid.

Undeterred by this, China continued the programme on its own. RA-78740 was salvaged from Israel (after IAI had removed the mission equipment) and flown to China for further modification in 2002. Designated KJ-2000 (Kong Jing-2000), the new version featured a surveillance radar developed by No. 14 Institute (aka the Nanjing Electronic Technology Research Institute) in Nanjing, Jiangsu Province. Like the Phalcon, the Chinese radar had three electronically steered phased arrays giving 360° coverage. It operated in the 1,200-1,400 MHz frequency range and has a target detection range of 470 km (292 miles).

Modification work at the Xian Aircraft Co. began in late 2002. Wearing CFTE logos and the new serial '762 Black', the KJ-2000 prototype made its first flight on 11th November 2003. This was followed by the conversion of three IL-76MDs formerly operated by China United Airlines – B-4040 (c/n 1053419656, f/n 9204), B-4041 (c/n 1053420663, f/n 9206) and B-4043 (c/n 1063420671, f/n 9208). Unlike the prototype, which retained the A-50's standard refuelling probe, the other three aircraft lacked IFR capability. They were also painted light grey overall and had a differently shaped SATCOM/SATNAV blister ahead of the wings.

After extensive flight testing by CFTE in Yanliang, Shaanxi Province, and radar system testing at an airbase near Nanjing, Jiangsu Province, the KJ-2000 entered service with the PLAAF's 26th Air Division in 2006-07. The four operational aircraft are now serialled '30071

B-4052, the first of two Boeing 737-300 airborne command posts, at Nanyuan AB.

The other Boeing 737-300 ABCP, B-4053, climbs away, showing the dorsal and ventral antenna blisters.

Red' through '30074 Red' and are based in Zhejiang Province. The KJ-2000 has a separate NATO reporting name, *Mainring*.

The KJ-2000 is 46.59 m (152 ft 10 in) long and 14.76 m (48 ft 5 in) high, with a wing span of 50.5 m (165 ft 8 in). It operates at altitudes of 5,000-10,000 m (16,400-32,810 ft). It has a take-off weight of 195,000 kg (429,900 lb), a range of 5,000 km (3,100 miles) on internal fuel and an endurance of 7-8 hours.

Boeing 737-300 airborne command post conversion

Between 1988 and 2003 the PLAAF's 34th Air Division tasked with government VIP transportation duties acquired eight Boeing 737-300 and two Boeing 737-700 twin-turbofan short/medium-haul airliners to provide domestic and international air transportation for high-ranking Chinese civil and military officials. These aircraft replaced the ageing Il'yushin IL-18V four-turboprop long-haul airliners (NATO reporting name *Coot*) and Hawker Siddeley HS.121 Trident 2B three-turbofan medium-haul airliners that had been used by the PLAAF as VIP transports since the early 1970s. Again, all ten Boeings were quasi-civil to facilitate flights abroad.

Two of these aircraft – Boeing 737-3Q8s registered B-4052 (ex PK-GWI, c/n 24701, f/n 1957) and B-4053 (ex PK-GWJ, c/n 24702, f/n 1994) – were purchased from the Indonesian flag carrier Garuda Indonesia in February 2000. These aircraft were converted into airborne command posts by the Xian Aircraft Co. These ABCPs are readily identifiable by the large dorsal teardrop-shaped dielectric fairing ahead of the wings and two smaller ventral dielectric blisters fore and aft of the wings; the fairings were associated with communications equipment (including sitcom). Unlike the VIP-configured Boeing 737s, which wore a corporate-style livery with a Chinese flag on the tail, B-4052 and B-4053 sported a grey low-visibility finish.

Once the existence of the ABCPs had become known, the fact was dragged into public view by a fraud-hunting gadfly – an American investigative journalist who raised hell, denouncing the modification as a direct violation of US-Sino trade agreements and US export laws. Officials at the US State Department and Department of Commerce refused to comment on the Chinese modification.

Gates Learjet 35A/36A ELINT conversion

In April 1984 China purchased two Gates Learjet 36A business jets from the United States; these were followed by three Learjet 35As in 1985. Officially, these were survey aircraft operated by CAAC in the prospecting, mapmaking and flood monitoring roles. In reality they were tactical ELINT aircraft flown by the PLAAF's 34th Air Division from Nan Yuan AB in southern Beijing. The aircraft wore unusual serials HY984 through HY988 (c/ns 36-053, 36-034 and 35-601 through 35-603 respectively).

All five aircraft were specially modified to carry optical cameras and other reconnaissance equipment. At least two of them were fitted with a synthetic aperture radar (manufactured by Loral Defence Systems) housed in a large black canoe fairing under the fuselage. These radar systems were sold to the Beijing-based National Remote Sensing Centre (NRSC) in the mid-1980s; hence the aircraft carried the NRSC logo.

Some of these highly secretive aircraft were deployed in Southern China during the 1980s Sino-Vietnam border conflicts to collect the intelligence of the Vietnamese forces. As a result of the US-led military embargo imposed in 1989, China was unable to import spare parts necessary for the maintenance and upgrade of these radar systems. Hence the original mission systems may have been replaced by Chinese ones, including the SAR.

Learjet 35A HY988 takes off, showing the large canoe fairing housing a synthetic aperture radar.

Il'yushin IL-76MD engine testbed

The Soviet/Russian Flight Research Institute (LII) in Zhukovskiy operated five highly specialised radar picket aircraft based on the IL-76MD and designated 'aircraft 976' or SKIP (*samolyotnyy*

76456, the former 'aircraft 976' converted into an engine testbed, on finals to Zhukovskiy. The test engine nacelle is empty and the intake is blanked off.

*ko**mahnd**no-izme**rit**el'nyy poonkt* – airborne measuring and control station). Outwardly they were similar to the A-50 AWACS, featuring an identical rotodome (although everything else was quite different) and hence bore the reporting name *Mainstay-C*.

The 'aircraft 976' were used for monitoring and recording systems operation of ballistic and cruise missiles during test launches. In the 1990s, however, the testing of such weapons came virtually to a standstill and the aircraft found themselves unwanted, languishing at Zhukovskiy. Hence in 2006 the fifth and final 'aircraft 976', CCCP-76456 (c/n 0073474208, f/n 5602), was converted into an engine testbed similar to the Soviet/Russian IL-76LL. The rotodome and its pylons were removed, and a new nacelle for a development engine was fitted in place of the port inboard Solov'yov D-30KP turbofan. Some of the distinctive antennas associated with the machine's previous role (including the wingtip antenna pods and the tail radome) were retained. The modification was performed at Zhukovskiy.

Wearing a smart white/red/grey colour scheme and the revised registration 76456, the testbed was delivered to the China Flight Test Establishment (CFTE), subsequently gaining a new identity, '760 Black'. The first engine to be tested on the aircraft was the Liming WS-10A Taihang afterburning turbofan developed for China's J-10 and J-11B fighters. The aircraft is based at CFTE's flight test facility at Yanliang.

The wingtip, pods and tail radome are a leftover from the machine's previous role but the test equipment heat exchangers on the fuselage sides are new.

8 Light Utility Aircraft

Development of light utility aircraft in China began in the mid-/late 1950s. Whilst the Chinese light utility and sports aircraft relied on components and design features borrowed from Soviet and other designs, they usually had no direct equivalents in the Soviet Union and elsewhere. Most of these aircraft remained in prototype form.

Feilong-1

In the late 1950s the Shanghai Aircraft Factory began reverse-engineering the Yakovlev Yak-12 *sans suffixe* cabin monoplane (NATO reporting name *Creek*). It was a four-seater with high-set wings braced by V-struts, a conventional strut/wire-braced tail unit, a fixed tailwheel landing gear and a 160-hp Shvetsov M-11FR five-cylinder radial in a helmeted cowling driving a two-bladed variable-pitch propeller.

Designated Feilong-1 (Flying Dragon-1), the Chinese version first flew on 15th September 1958 in landplane configuration. Later, when initial flight tests had proved the aircraft met the performance target, it was fitted with twin floats, becoming the Chinese equivalent of the Yak-12G and the first Chinese floatplane. In this form it was tested in the Yangtze River estuary. The Feilong-1 was intended for offshore search and rescue, liaison, observation/fishery survey etc.

The aircraft was 8.76 m (28 ft $8\frac{7}{8}$ in) long and 3 m (9 ft $10\frac{7}{64}$ in) high, with a wing span of 12.09 m (39 ft $7\frac{63}{64}$ in) and a maximum take-off weight of 1,592 kg (3,509 lb). The top speed was 130 km/h (80.78 mph) and the range was 300-600 km (186-372 miles), depending on the configuration.

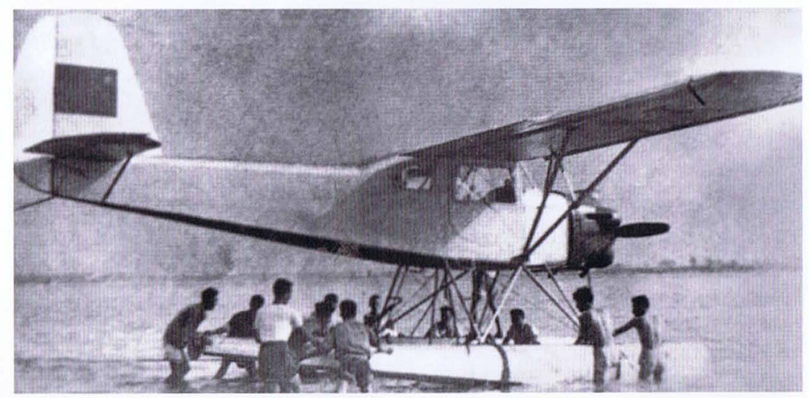
Shen Hang-1

At the same time the Shenyang Aviation Polytechnic School created another carbon copy of the M-11FR-powered Yak-12 – the first aircraft to be built by a secondary technical school in China. Designated Shen Hang-1, it first flew on 7th October 1958. Applications envisaged for the Shen Hang-1 included passenger transportation, liaison, medevac, crop-spraying and cloud-seeding to cause artificial precipitation.

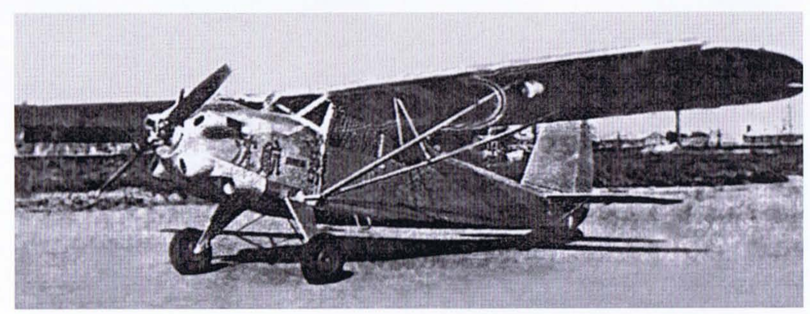
The aircraft had a maximum take-off weight of 1,590 kg (3,505 lb), a maximum speed of 170 km/h (105 mph), a service ceiling of 4,000 m (13,120 ft) and a range in excess of 400 km (248 miles).

Yan'an-1

Developed by the Northwest Polytechnic University, the Yan'an-1 light aircraft (Yan'an is a geographical name) was an indigenous design, albeit a rather ungainly one. It was similar in layout to the Yak-12 *sans suffixe* but slightly larger. The fuselage was cut away from below aft of the cabin, creating a tadpole



The Feilong-1 light aircraft afloat on the Yangtze River.



The Shen Hang-1, another Chinese clone of the Yak-12.

'01 Red', the Yan'an-1 light aircraft. The legend on the fuselage is the aircraft's name in Chinese.

effect; the wing bracing struts were single, and so were the main landing gear struts (the Yak-12 had faired V-struts). The engine was again an M-11FR but it was enclosed by a horizontally split NACA cowling with a 'solid' front incorporating small cooling air inlets for the five cylinders.

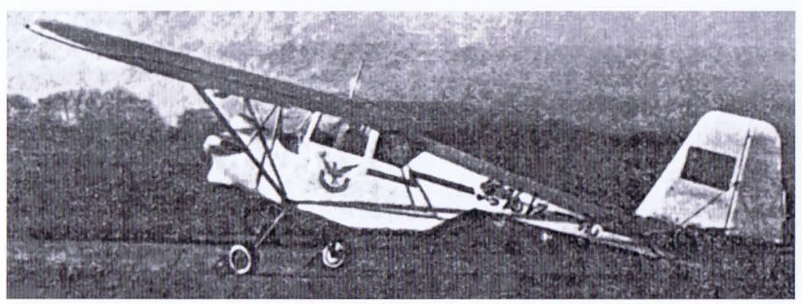
Bearing the tail number '01 Red', the aircraft made its first flight on 3rd December 1958. The Yan'an-1 was to be used mainly for parachuting and crop-spraying, with a chemical hopper aft of the pilot; other possible applications included passenger and small cargo transportation, liaison, SAR and glider towing.

The aircraft was 9.06 m (29 ft 8 45/64 in) long, with a wing span of 13.55 m (44 ft 5 15/32 in). The maximum take-off weight was 1,400 kg (3,086 lb), including a 570-kg (1,256-lb) payload; the Yan'an-1 attained a maximum level speed of 204 km/h (126 mph) and a range of 500 km (310 miles).

Heilongjiang-1

This multi-purpose machine was created by the Harbin Aviation Polytechnic School and was another indigenous design. It was likewise powered by an M-11FR five-cylinder engine. The forward/centre fuselage up to the wing trailing edge (including the cowling design), the wings proper and the landing gear resembled those of the Yak-12 but the rest of the fuselage was quite different, with an even more pronounced tadpole effect; the vertical tail was more angular. Like the designs described above, the Heilongjiang-1 (also a geographical name) was conceived for agricultural, transport, SAR and liaison tasks. The first flight took place on 16th December 1958.

The slender rear fuselage of the Heilongjiang-1 makes the machine look rather fragile.



The aircraft was 12.1 m (39 ft 8⅜ in) long and 2.63 m (8 ft 7 35/64 in) high, with a wing span of 12.1 m. The take-off weight was 1,253 kg (2,762 lb), the maximum level speed was 156 km/h (97 mph) and the range was 668 km (415 miles).

Hongqi-1

The Hongqi-1 (Red Flag-1) multi-purpose aircraft was developed by the Beijing Aviation Polytechnic School. Once again, it was a high-wing monoplane with V-shaped wing bracing struts, a conventional tail unit and a tailwheel landing gear. The fuselage utilised a pod-and-boom design and incorporated clamshell loading doors at the rear of the cabin, pilot access being via a car-type door to port. The strut-braced tailplanes were set low on the tailboom. The pyramidal main landing gear units had V-struts hinged on the fuselage centreline and long-stroke oleos outboard. Power was provided by a 260-hp HS-6 nine-cylinder radial (licence-built Ivchenko AI-14) enclosed by a NACA cowling with radial shutters at the front and driving a two-blade propeller.

The Hongqi-1, which entered flight test on 22nd December 1958, was primarily an agricultural aircraft but could also be used for passenger, mail and cargo carriage. It was 9.457 m (31 ft 0 21/64 in) long and 3.2 m (10 ft 6 in) tall, having a wing span of 13.5 m (44 ft 3½ in). The maximum take-off weight was 1,420 kg (3,130 lb) and the payload was 468 kg (1,031 lb); the aircraft had a top speed of 200 km/h (124 mph) and a range of 700 km (435 miles).

The BIAA Mifeng series

In late 1978 a design team led by Hu Jizhong at the Beijing Institute of Aeronautics and Astronautics (BIAA) began development of a microlight aircraft known as Mifeng-1 (Honeybee-1), which was tested successfully in June 1979. The Mifeng-1 was actually a radio-controlled model with an all-up weight of 100 kg (220 lb) built as a subscale proof-of-concept vehicle.

In early 1982 the team set to work on the first real aircraft in the series – the Mifeng-2. It was a single-seater with a teardrop-shaped fuselage pod above which wire-braced parasol wings were carried on a tubular cabane and to which a cruciform tail unit was attached by converging tubular struts. The wings and tail surfaces were fabric-covered. The aircraft had a tricycle landing gear and was powered by a two-cylinder air-cooled engine driving a two-blade pusher propeller. The aircraft entered flight test in the summer of 1982; apart from leisure flying, it could be used for patrol and photo survey duties.

The experience gained with the Mifeng-2 came in handy when developing the larger, two-seat Mifeng-3. This aircraft, too, used a parasol layout but in this case the wings were attached to a system of tubular struts and the tail unit was carried on a triangular-section truss. As in the case of the single-seat precursor, the tandem cockpits were open; the rear seat could be removed for carrying small cargoes or installing mission equipment, such as a chemical tank for crop-spraying work.

The aircraft was 6 m (19 ft 8 7/32 in) long and 2.6 m (8 ft 6 23/64 in) high, with a wing span of 10 m (32 ft 9 45/64 in). The take-off weight was 366 kg (807 lb) and the maximum payload was 100 kg (220 lb).

The maiden flight took place in July 1983. Barely a month later, on 13th August, the prototype had its operational debut as an agricultural aircraft when it was called upon to combat locusts infesting rice paddies at the Northern Suburb Farm near Beijing. Fitted with Type 3WQ-1 spray gear and a 60-kg (132-lb) liquid pesticide tank, the aircraft covered a swath more than 30 m (98 ft) wide in a single pass. As a result, 92% of the pests were destroyed. Another pest control mission in the course of the flight tests took place on 13th October – 4th November 1983. This time the Mifeng-3 was used to exterminate hawk moths infesting pine forests at a forestry farm in Lishui County, Jiangsu Province. Operating in hilly terrain, the aircraft coped admirably with the task – the kill rate reached 90%.

A biplane version also existed. It reportedly made its first flight on 21st August 1983.

In June 1984 the Mifeng-3 received a type certificate and entered production. On 4th-28th September 1989 three Mifeng-3C aircraft equipped with long-range fuel tanks replacing the rear seat took part in a 5,000-km

The Mifeng-2 single-seat microlight aircraft.

The two-seat Mifeng-3.

The Mifeng-3D has a different rear fuselage truss.

The Mifeng-11 differs considerably from the other aircraft in the series.

(3,105-mile) flight from Urumqi to Harbin to celebrate the 40th anniversary of the Chinese socialist revolution and the establishment of the People's Republic of China. In the course of the flight the machines set a national record for ultralight aircraft by flying for six hours at an altitude of 4,000 m (13,120 ft) and covering 460 km (285 miles) in so doing.

Further versions followed soon. In particular, the Mifeng-4 (first flown in September 1984) and the two-seat Mifeng-5 were both based on the production Mifeng-3 model. The later Mifeng-11 was a very different design; while sharing the same basic high-wing, tandem-seat, pusher-engine layout it had an enclosed cockpit, a real tailboom instead of an exposed truss, and non-parasol wings.

Huabei Qingting-5

The Huabei Machinery Factory in Shijiazhuang, formerly known as the Hongxing factory, also built several models of ultralight aircraft known collectively as *Qingting* (Dragonfly). Development of the Qingting-5 model began in 1982; this was a classic 'trike' with a fuselage structure made of metal tubes (exposed, save for an optional nose fairing with a windscreen), wire-braced parasol wings and high-set cruciform tail surfaces. The engine was located aft of the pilot's seat, driving a pusher propeller. All flying surfaces were skinned with Dacron fabric, and roll control was achieved by wing warping.

'03 Blue', the third example of the Qingting-5 microlight, with the optional nose fairing.

The baseline Qingting-5 was a single-seater; the machine was 5.36 m (17 ft 7 in) long and 2.84 m (9 ft $3\frac{13}{16}$ in) high, with a wing span of 10.55 m (34 ft $7\frac{23}{64}$ in). The maximum take-off weight was 241 kg (531 lb) and the top speed was 88 km/h (54.7 mph). The aircraft achieved quantity production. Later, two-seat versions were brought out; the Qingting-5A had side-by-side seating while the Qingting-5B had tandem seats.

Huabei Qingting-6

Another ultralight created by the Huabei factory was the Qingting-6 – a low-wing aircraft of riveted aluminium construction with strut-braced wings, two slender tailbooms with twin vertical tails joined at the top by a tailplane, an open cockpit, a tricycle landing gear with cantilever-spring main legs, and a horizontally opposed engine driving a two-blade pusher propeller. The aircraft was intended for agricultural tasks and forestry protection, being optimised for low- and ultra-low-volume spreading of chemicals or seeds.

The single-seat Qingting-6 performed its maiden flight on 13th September 1984. It was 6.67 m (21 ft $10\frac{19}{32}$ in) long and 1.74 m (5 ft $8\frac{1}{2}$ in) tall, with a wing span of 9.8 m (32 ft $1\frac{53}{64}$ in). The take-off weight was 500 kg (1,102 lb); the aircraft attained a maximum speed of 132 km/h (82 mph) and a range of 220 km (136 miles). A two-seat version designated Qingting-6A also existed; apart from training, it could be used for geological prospecting, mail delivery, patrol and photo survey tasks.

NAI/Adaso AD-100 Voyager

In the early 1980s the Nanjing Aviation Institute (NAI; now the Nanjing University of Aeronautics and Astronautics) teamed up with a US company called Adaso, Inc. to create a light aircraft that would have export potential. The first product of this joint venture was the AD-100 Voyager, a single-seat aircraft utilising the canard layout. The airframe was of glassfibre reinforced plastic (GRP) honeycomb construction. The unswept foreplanes were low-set, whereas the shoulder-mounted wings were slightly swept back and carried oblong endplate fin/rudder assemblies. The machine had a fixed tricycle landing gear and a pusher propeller.

The AD-100, which first flew in August 1985, was designed to meet FAR Pt 103 requirements. It was 5.02 m (16 ft $5\frac{41}{64}$ in) long and 1.71 m (5 ft $7\frac{21}{64}$ in) tall, the wing span being 8.68 m (28 ft $5\frac{47}{64}$ in); it had an empty weight of 126 kg (278 lb) and grossed at 240 kg (529 lb) for take-off. The aircraft had a top speed of 120 km/h (74.5 mph), a cruising speed of 85 km/h (53 mph), a take-off run of 60 m (200 ft) and a range of 300-350 km (186-217 miles). Production started in 1986, the first deliveries being made to Australia.

A production Qingting-6 light aircraft.

The AD-100 light aircraft. Note the tail bumper preventing a propeller strike.

The later AD-200 has a different layout with mid-set wings.

An example of the AD-200 is on display at the PLAAF Museum in Xiaotangshan.

NAI/Adaso AD-200

Later, NAI and Adaso developed one more aircraft, the AD-200. It was likewise a single-seat canard of GRP honeycomb construction but the layout was markedly different; the foreplanes were high-set and the wings were mid-set, the vertical tails at the wingtips being upturned and looking like the winglets of a modern airliner. The cockpit canopy, too, was revised, featuring a fixed windshield (the AD-100 had a one-piece canopy).

The AD-200 was slightly larger than the precursor, with an overall length of 6.4 m (21 ft 0 in), a height of 2.058 m (6 ft 9 in) and a wing span of 9.6 m (31 ft 5$\frac{61}{64}$ in). The maximum take-off weight was 420 kg (926 lb); the maximum speed was 140 km/h (87 mph) and the maximum range was 360 km (223 miles).

The Nanchang Haiyan in manufacturer's colours.

Nanchang Haiyan

The Haiyan (Storm petrel) was a civilian utility version of the PLAAF's standard CJ-6 primary trainer (see Chapter 5), being outwardly identical to the latter model. It was intended as an observation/patrol aircraft and even as an agricultural aircraft. To cater for the higher gross weight involved, the standard 285-hp HS-6A engine was replaced by a 345-hp HS-6D.

Development began in May 1985 and the prototype wearing a smart civilian colour scheme but no registration or serial first flew on 17th August that year; it was designated Haiyan A. The aircraft had a 400-kg (880-lb) chemical tank replacing the rear seat; another 200 kg (440 lb) of chemicals were carried in bays in the wing centre section leading edge. The chemicals were fed to four Type 751 sprinkler heads mounted under the wings by a modified LB-4 fuel pump, giving a swath width of 30 m (98 ft).

The production-standard agricultural and forestry protection version was called Haiyan B. The Haiyan C was the patrol version retaining the rear seat and increased fuel tankage to give an endurance of more than six hours.

The overall dimensions were identical to those of the trainer version. The Haiyan A had an empty weight of 1,214 kg (2,676 lb), a maximum take-off weigh of 2,035 kg (4,486 lb) and a payload of 700 kg (1,540 lb). The normal operating speed was 160 km/h (99 mph) and the top speed was 297 km/h (184.5 mph); the maximum operating altitude was 6,250 m (20,500 ft) and the range was 780 km (484 miles). The aircraft had a 280-m (920-ft) take-off run and a 350-m (1,150-ft) landing run; the endurance was 4 hours 11 minutes.

SLAC HU-1

In 1981 the Shenyang Light Aircraft Co. started development of a powered glider designated HU-1. It was an elegant machine, with a carefully streamlined fuselage pod accommodating two pilots side by side in an enclosed cockpit, a circular-section tailboom carrying a T-tail, shoulder-mounted cantilever wings, and a bicycle undercarriage with outrigger wheels under the wingtips. The carefully cowled flat-four engine was located above the wing trailing edge, driving a two-blade pusher propeller. While primarily intended as a trainer, the glider had potential uses as a patrol aircraft and an aerial photography/remote sensing platform. The prototype took to the air in October 1987.

The HU-1 was 7.62 m (25 ft 0 in) long and 1.73 m (5 ft 8$\frac{7}{64}$ in) tall measured at the top of the tail, with a wingspan of 17 m (55 ft 9$\frac{19}{64}$ in). At a 1,050-kg (2,315-lb) take-off weight, it achieved a top speed of 185 km/h (115 mph) and a range of 1,000 km (621 miles).

This shot portrays well the elegant lines of the HU-1 powered glider.

Chengdu CA-1

In July 1985 the Chengdu Aircraft Corp. began flight tests of the CA-1 multi-purpose ultralight aircraft. This was a fairly conventional design with an open cockpit, strut-braced parasol wings and a tricycle landing gear. The tail unit featuring closely spaced twin fins and a low-mounted tailplane was carried on twin tailbooms. Power was provided by a high-set flat-four engine with a pusher propeller. The aircraft was 11.4 m (37 ft 4$\frac{13}{16}$ in) long and 1.8 m (5 ft 10$\frac{7}{8}$ in) tall, with a wing span of 11.4 m; the take-off weight was 350 kg (770 lb). The CA-1 attained a top speed of 100 km/h (62 mph) and a range of 364 km (226 miles).

In addition to the usual roles (sports, agriculture etc.) CAC envisaged military applications for the aircraft. This probably means observation, as the low TOW and payload do not make the CA-1 eminently suitable for the counter-insurgency (COIN) role.

Nanchang N5

In the late 1980s the Nanchang Aircraft Manufacturing Co. started development of a specialised agricultural aircraft – a smaller and lighters successor to the venerable Y-5. The basic design criteria were good operating economics, high flight safety, good working conditions for the pilot and the ability to operate from short unprepared airstrips.

N5A

Designated N5A, the machine utilised the basic layout of most western ag-planes. It was a low-wing monoplane of all-metal construction with a conventional tail unit and the chemical hopper placed near the aircraft's CG between the engine and the single-seat cockpit. The latter was set high to provide a good field of view over the long nose and sealed against the ingress of toxic chemicals. Full-span spraybars could be fitted, with a windmill-driven pump under the fuselage; alternatively, a tunnel-type dust spreader could be fitted.

Yet there were a few peculiarities. The cantilever dihedral wings of constant chord had a supercritical airfoil and small leading-edge root extensions. Unlike most single-seat agricultural aircraft, which were taildraggers, the N5A had a wide-track tricycle landing gear.

The CA-1 light aircraft.

An unmarked N5A agricultural aircraft with spraybars attached.

The powerplant was a 400-hp Textron Lycoming IO-720-D1B air-cooled flat-four engine driving a Hartzell HC-C3YR-1RF/F8475R three-bladed propeller.

The first prototype (B-501L, c/n N5A001) made its first flight on 26th December 1989. Another prototype was registered B-530L.

The N5A received its Chinese type certificate in July 1992 and a production certificate in June 1995, entering limited production at Nanchang; a number of these aircraft is operated by Changjiang General Aviation. On 26th February 2007 the aircraft was certified by the US FAA. In addition to agricultural tasks (sowing, top-dressing and pest control), the N5A can be used for firefighting; in this case the chemical hopper is filled with a water/fire retardant mixture.

Specifications of the Nanchang N5

	N5A	N5B
Length overall (flying attitude)	10.487 m (34 ft 4 7/8 in)	10.485 m (34 ft 4 3/4 in)
Wing span	13.418 m (44 ft 0 1/4 in)	13.295 m (43 ft 7 1/2 in)
Height overall	3.782 m (12 ft 4 57/64 in)	3.88 m (12 ft 8 3/4 in)
Wheel track	n.a.	3.53 m (11 ft 7 in)
Hopper capacity, m^3 (cu ft)	n.a.	1.6 (56.5)
Maximum take-off weight, kg (lb)	2,250 (4,960)	n.a.
Maximum payload, kg (lb)	960 (2,116)	1,500 (3,307)
Maximum level speed, km/h (mph)	289 (179)	237 (147)
Stalling speed, flaps down, km/h (mph)	n.a.	111 (69)
Maximum rate of climb at sea level, m/sec (ft/min)	n.a.	60 (1,181)
Service ceiling, m (ft)	n.a.	6,000 (19,685)
Take-off run, m (ft)	n.a.	251 (825)
Landing run, m (ft)	n.a.	198 (650)
Chemical dispersal, kg/m^2 (lb/sq ft):		
liquid	n.a.	5 (1.02)
granular	n.a.	15 (3.07)
Maximum range, km (miles)	n.a.	1,010 (627)
Endurance, hours	2	6

N5B

The current version designated N-5B is a lot different from the original aircraft, featuring a tailwheel landing gear and being powered by a 777-shp Walter M-601F turboprop driving a three-blade variable-pitch Avia propeller.

NUAA FT300

The UAV Design Institute, a division of the Nanjing University of Aeronautics and Astronautics, brought out a three-seat multi-purpose light aircraft in the early 1990s. Designated FT300, it utilised a canard layout with large low-set foreplanes and shoulder-mounted wings with slight sweepback; the wings carried angular endplate fins and rudders. 80% of the structure was composite materials. The flat-four engine drove a two-blade pusher propeller. Two passengers were seated side by side behind the pilot. The maximum take-off weight was 620 kg (1,366 lb)

The prototype entered flight test in June 1994, being operated both with a tricycle wheeled landing gear and with twin floats, showing a top speed of 150 km/h (93 mph) and a range of up to 500 km (310 miles). Possible applications include pilot training (dual controls are provided), ship liaison and anti-smuggling operations.

XADRI Small Eagle 100

First flown on 25th January 1995, the Small Eagle 100 developed by the Xian Aviation Design & Research Institute (XADRI) is a two-seat microlight utilising an open truss fuselage structure, wire-braced parasol wings, cruciform tail surfaces (both with Dacron skinning) and a tricycle landing gear. No data are available.

Sea Gull-100 (A1) and Sea Gull-200

Developed by the Chinese Water-based Aircraft Design & Research Institute, the Sea Gull-100 (A1) ultralight aircraft was mainly intended for agricultural and forestry protection tasks. It first flew in May 1984 and was used for aerial sowing and pest control operations over areas with varying terrain in Xinjiang, Fujiang, Shanxi, Hunan and Hubei Provinces for a full year (July 1984 to July 1985) as part of the tests. The machine was 5.92 m (19 ft 5 5/64 in) long and 3.1 m (10 ft 2 3/64 in) high, with a wing span of 10.43 m (34 ft 2 5/8 in); it had a take-off weight of 320 kg (705 lb), a top speed of 85 km/h (52 mph) and a range of 130 km (80 miles).

The next ultralight aircraft developed by the same team, the Sea Gull-200, was apparently a bigger and heavier version of the 100 model. Outwardly it strongly resembled the Mifeng-3 described earlier, featuring fabric-covered parasol wings and cruciform tail surfaces attached to a fuselage pod by a system of tubular struts; the two-cylinder inline engine sat on top of the wings, driving a pusher propeller. The open cockpit seated two in tandem.

The Sea Gull-200 had a tricycle landing gear as standard but could be fitted with twin floats. It was 6.641 m (21 ft 9 29/64 in) long and 3.2 m (10 ft 6 in) tall, with a wing span of 10.91 m (35 ft 9 33/64 in); the take-off weight rose to 510 kg (1,125 lb). The aircraft attained a top speed of 110 km/h (68 mph) and a range of 200 km (124 miles).

GEAC EV-97

In June 2000 the Guizhou Aircraft Industry Corp. formed a joint venture with the Czech company Evektor Aerotechnik called Guizhou Evektor Aircraft Corp. (GEAC). The new company was to produce and market the Evektor EV-97 teamEurostar two-seat light aircraft, assembling the machines from CKD kits. A single kit was imported in August 2000 and the pattern aircraft took to the air on 24th October that year; however, no more were assembled and the partnership apparently folded by 2002. (The EV-97 reappeared at Airshow China-2002, labelled as a joint venture between Evektor and the Shanghai Aircraft Co.).

NLA AC-500 Aircar

The Nanjing Light Aircraft Co. (NLA) was set up in 1998 by NUAA, the municipality of Nanjing, the government of Jiangsu Province and other partners for the purpose of developing and producing the AC-500 Aircar five-seat aircraft. NUAA was responsible for the design work.

The AC-500 was designed along the same lines as, say, the Piper PA-28-161 Warrior, featuring low-set dihedral wings, a conventional tail unit and a fixed tricycle landing gear. The powerplant was a 260-hp Textron Lycoming IO-540 flat-six engine driving a three-blade propeller. The cabin had three rows of seats, the centre row facing aft; access was via two car-type doors at the front and a port side door at the rear.

The aircraft was 8.14 m (26 ft 8 1/2 in) long and 3.05 m (10 ft 0 in) tall, with a wing span of 10.2 m (33 ft 5 1/2 in); the wheelbase and the wheel track were 2.18 m (7 ft 1 3/4 in) and 2.8 m (9 ft 2 1/4 in) respectively. The design maximum take-off weight was 1,540 kg (3,395 lb). The AC-500 was to have a maximum speed of 250 km/h (155 mph), a stalling speed of 110 km/h (69 mph), a service ceiling of 3,000 m (9,840 ft) and a range of 800 km (496 miles).

The FT300 three-seat light aircraft in floatplane configuration.

The XADRI Small Eagle-100 two-seat light aircraft.

The fifth Seagull 200 light aircraft in landplane configuration.

The Seagull 200 can also be fitted with floats, as illustrated by the seventh machine built.

The first prototype (c/n 0001) built at the Nanchang Aircraft Manufacturing Co. was exhibited at Airshow China 2000 at Zhuhai-Sanzao in November. Yet the maiden flight did not take place until May 2004. The second prototype (c/n 0004) took to the air on 3rd December 2004, but officially the first flight date was recorded as 7th December; this aircraft was in trainer configuration with dual controls. The prototypes were later registered B-660L and B-662L. C/ns 0002 and 0003 were ground test articles.

Chinese certification trials took place on 4th-8th December 2005, involving 181 flights; production was due to begin in March 2006.

Shijiazhuang LE-500 Little Eagle (Kitty Hawk) cabin monoplane

Development of this four/five-seat cabin monoplane reminiscent of the SOCATA TB-20 Trinidad began in 2000 as a joint effort of the Shijiazhuang Aircraft Industry Co. (SAIC), XADRI and the Civil Aviation Flight University of China (CAFUC). The LE-500 Little Eagle had an all-metal airframe with low-mounted dihedral wings, conventional tail surfaces with a swept fin and a retractable tricycle landing gear. The cabin was accessible via upward-opening doors. Power was provided by a 260-hp Textron Lycoming IO-540-V4A5 flat-six engine driving a Hartzell HC-C2YK-1BF/F8477-4-80 two-blade constant-speed propeller of 2.03 m (6 ft 8 in) diameter.

The gaudily painted prototype LE-500 Little Eagle registered B-649L.

A full-size mock-up was unveiled at Airshow China 2002. The prototype (B-649L) made its first flight on 26th October 2003. Upon completion of the flight test programme, which involved 339 flights, in April 2005 the LE-500 received its type certificate in October 2005. Production began in early 2007, with CAFUC and the Qingdas Jiutian Spartan Flight Academy as the first customers.

In addition to the trainer role, the LE-500 can be used for executive and leisure flights, agricultural and forest protection work, environmental patrol, aerial survey and photography, police and military operations. For export the aircraft is marketed as the Kitty Hawk.

The LE-500 is 7.745 m (25 ft 5 in) long and 3.045 m (10 ft 0 in) high, with a wing span of 9.88 m (32 ft 5 in). The maximum take-off weight is 1,400 kg (3,0861b), including a 560-kg (1,235-lb) payload.

Shijiazhuang LE-800 executive aircraft (project)

At Airshow China-2004 SAIC revealed that it was developing an executive turboprop aircraft designated LE-800 jointly with the No. 1 Aircraft Institute. A model displayed at the event showed a machine in the same class as (and externally similar to) the Piper Malibu, SOCATA TBM700 and Myasishchev M-101T Sokol – a low-wing aircraft seating up to ten and having conventional tail surfaces with a swept fin, a retractable tricycle landing gear and a single engine. The powerplant in this case was a Pratt & Whitney Canada PT6A (the exact model and hence power rating is not known) driving a four-blade propeller. The LE-800 is to be 11.00m (36 ft 1 in) long, with a wing span of 14.7 m (48 ft 2¾ in), and an empty weight of 2,000 kg (4,409 lb).

9 Helicopters

A major PLA airborne assault operation involving Z-5 helicopters.

Helicopter design and construction in China began in the late 1950s. Again, while the majority of the helicopters built in China are licence-built foreign designs (from the USSR and the western world) or their derivatives, attempts have been made from the outset to create indigenous rotary-wing aircraft. Development work was undertaken by such R&D establishments as the Nanjing Aviation Institute (NAI) and the China Aerodynamics Research and Development Centre; later, a specialised China Helicopter Research and Development Institute (CHRDI) was set up at Jingdezhen, Jiangxi Province.

Harbin Z5 multi-role helicopter

The first helicopter selected for production in China was the Mil' Mi-4 (NATO reporting name *Hound*), a Soviet medium helicopter which first flew in 1952 and entered production in December that year. It utilised a conventional single-rotor layout with a four-blade main rotor and a three-blade tail rotor. The all-metal airframe was similar to that of the Sikorsky S-55 – the fuselage was of pod-and-boom construction, with the engine bay in the extreme nose; the two-man cockpit was

PLA soldiers use a rope ladder to disembark from a hovering Z-5.

The same helicopter disgorges a Soviet-built GAZ-67B jeep.

located above the passenger/cargo cabin and aft of the engine main gearbox and fuel tanks being placed aft of the cockpit. The engine was a 1,700-hp Shvetsov ASh-82V 14-cylinder radial connected to the main gearbox by a long extension shaft. The cabin featured clamshell rear loading doors and could accommodate 12-16 troops or a load of 1,200-1,600 kg (2,645-3,530 lb), such as a jeep or a field gun.

Several Z5s reside at the PLAAF Museum. '7272 Red' is the basic assault version with a gunner's 'bathtub'; '3685 Red' is a VIP example, while '3529 Red' is an ambulance helicopter.

China obtained licence manufacturing rights for the Mi-4 in 1956, and the Harbin Aircraft Factory was chosen to build the type. The Chinese version was designated Z5 (*Zhishengji* – Vertical take-off aircraft, type 5). Technology transfer began in 1956 and was completed in early 1958. The factory started building the Z5 prototypes straight away while the transfer of the manufacturing documents was still in progress. The co-located Harbin Engine Factory (HEF), formerly a weapons plant, launched production of the licence-built ASh-82V as the HS-7. Piloted by Qian Guangyou and Liu Xingxiang, the first prototype made its maiden flight on 14th December 1958, four months ahead of schedule. In December 1959 the helicopter was certificated for production.

However, the Z5 fell victim to the 'Great leap forward' policy and associated emphasis on quantity and production rate to the detriment of quality. Haste makes waste – the early batches were so substandard that production had to be halted in 1960; the jigs and tooling were thrown out and designed anew. New manufacturing drawings were issued in March 1961 and a Z5 prototype manufactured according to these drawings made the 'second maiden flight' on 20th August 1963. This time the quality was acceptable, and on 21st September 1963 the helicopter was formally cleared for production after completing its certification tests.

The Harbin Aircraft Factory kept refining the Z5. The original main rotor blades were of mixed construction with a steel tube spar and wooden pockets, and the Soviet technical requirements concerning the grade of wood to be used were very stringent. Finding the right timber proved to be a major challenge, and then felling the trees high in the mountains was difficult, not to mention the massive deforestation. Therefore in May 1963 the Harbin Aircraft Factory's design office began developing all-metal main rotor blades with a bonded honeycomb filler. A Z5 fitted with such blades took off for the first time on 22nd June 1966 and the new blades proved to be superior to the wooden ones.

VIP-configured Z5 '6-07' was one of several Albanian Air Force examples.

A late prototype of the Z6 transport helicopter; note the sliding flightdeck doors. The commonality with the Z5 is obvious.

When production ended in 1979, the factory had completed 575 Z5s in various versions. The vast majority (437 units) were in the basic transport/assault version with a ventral gondola for a prone gunner, although some of these were apparently modified for specific missions. Apart from China, a number of Z5s was supplied to Albania, which had severed its links with the Soviet Union.

The Z5's overall length with rotors turning was 25.017 m (82 ft 0$\frac{59}{64}$ in); the helicopter was 4.4 m (14 ft 5$\frac{7}{16}$ in) high, with a main rotor diameter of 21.0 m (68 ft 10 $\frac{49}{64}$ in). The maximum take-off weight was 7,600 kg (16,755 lb); the normal payload, maximum internal payload and maximum slung load were 1,200 kg (2,645 lb), 1,550 kg (3,417 lb) and 1,300 kg (2,866 lb) respectively. The maximum forward speed was 210 km/h (130.5 mph) and the maximum range with an external tank was 780 km (484 miles).

Front view of the Z6, showing the single engine air intake and the twin oil cooler intakes above it.

Z5 assault helicopter

In addition to the forward-firing machine-gun in the abovementioned gondola (manned by the flight engineer), some Z5s operated by the PLA aviation were fitted with weapons outriggers for carrying unguided rocket pods. They were thus the Chinese counterpart of the Soviet Mi-4AV, although the latter carried up to eight rocket pods. Such helicopters are included into the abovementioned figure of 437.

The Z6 has few competitors for the title of The World's Ugliest Helicopter! '0002 Red', the first prototype shown here, had forward-hinged flightdeck doors and a circular window in the cabin entry door.

One of the six Z6 helicopters built survives at the PLAAF Museum.

Z5 minelaying helicopter

A version of the Z5 developed for the PLA was outfitted for aerial minelaying, dispensing anti-tank mines equipped with small parachutes to slow their fall. Interestingly, it had no gunner's gondola. Such helicopters are apparently also included into the figure of 437.

Z5 Xuanfeng commercial helicopter

86 examples of the Z5 were built in a civil passenger version roughly equivalent to the Mi-4P. Such helicopters lacked armament and were referred to in some sources by the name Xuanfeng (Whirlwind).

Z5 VIP helicopter

A number of Z5s were built for the PLAAF and the Albanian Air Force as VIP helicopters identifiable by the rectangular cabin windows instead of the normal circular ones, in the manner of the Mi-4P and Mi-4S (the Soviet VIP version). One such helicopter was used by the Chinese Prime Minister Zhou En-lai. The VIP machines are presumably included into the 86 mentioned above.

Z5 agricultural version

Seven Z5s were completed in an agricultural version – the counterpart of the Mi-4SKh, featuring chemical hoppers and spreader gear. These machines also found use for forestry protection.

Z5 SAR version

13 examples of the Z5 were built in a search and rescue (SAR) version roughly equivalent to the Mi-4SP. Few details are known but it is known that the SAR version had external fuel tanks giving longer range and endurance.

Z5 survey version

Two Z5s were completed in a special aerial survey version.

Another view of the Z6 preserved at Xiaotangshan.

Harbin/CHRDI Z6 multi-role helicopter

The production Z5 was underpowered and had poor 'hot-and-high' performance as far as the Chinese military were concerned, so a requirement was issued for a more capable medium transport helicopter powered by a turbine engine. Hence in 1966 the Harbin Aircraft Factory began development of such a machine designated Z6; later the design work was transferred to the newly established CHRDI.

The Z6 was based on the Z5's airframe and rotor system. The fuselage was extensively redesigned – an extensively glazed flightdeck with lateral doors occupied the extreme nose instead of the engine bay. The engine, a 2,200-shp WZ5 turboshaft engine, was mounted above the front end of the cargo cabin in front of the new main gearbox, with oil coolers for both of them positioned above the bifurcated engine exhaust pipe (that is, immediately ahead of the main rotor shaft). The quadricycle landing gear was retained.

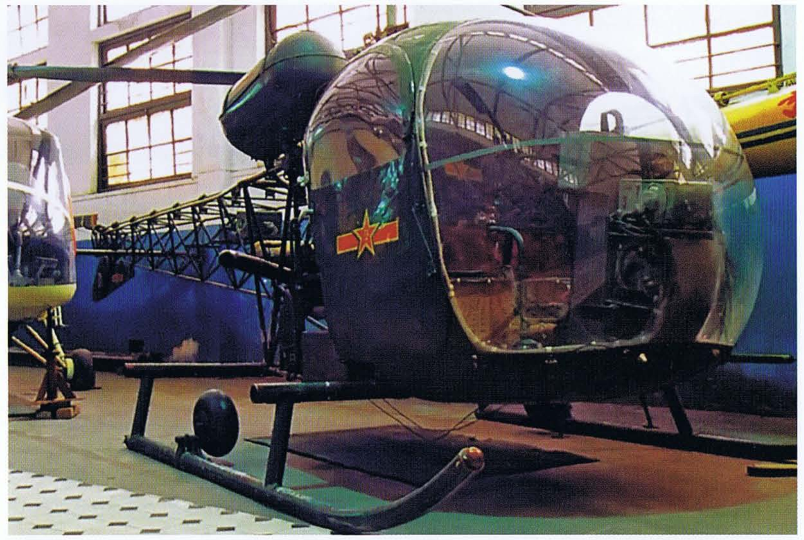
The WZ5 (*Wozhou* – turboshaft engine) was derived by HEF and the Zhuzhou Aero-engine Research Institute (ZARI) from the WJ5 turboprop (Ivchenko AI-24 copy) powering the Xian Y7 airliner (licence-built An-24). Thus, we may say the Z6 paralleled the development of the Mil' Mi-8 (NATO reporting name *Hip*); the latter, too, started life as a much-modified Mi-4 derivative and was initially powered by a single AI-24V turboshaft.

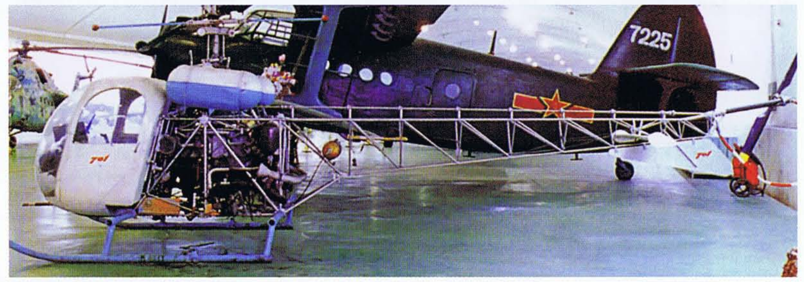
The first prototype Z6 ('0002 Red') made its maiden flight on 15th December 1969 with Wang Peiming at the controls. Preparations for series production began in 1970 in three provinces (Jiangsu, Jiangxi and Heilongjiang); interestingly, the names of all three featured the 'jiang' ('propeller') component! The Hongzhuang ('Red Craftsman') Machinery Factory in Changzhou, Jiangsu Province, was responsible for final assembly.

Inevitably, the helicopter had its fair share of teething troubles, such as excessive vibration, insufficient tail rotor thrust, engine and main gearbox oil overheating and so on. These were dealt with in due course. The programme suffered a severe setback when one of the prototypes crashed fatally on 7th August 1972. Nevertheless, the test results were deemed successful and the Z6 received its type approval in 1977.

Still, the helicopter did not enter mass production. One reason for this was that the single engine did not ensure adequate flight safety and no suitable turboshaft was available to permit development of a twin-engined version. Besides, the Z6's performance was actually *inferior* to that of the older Z5. Only eleven examples were built, the type becoming a milestone in Chinese helicopter technology development.

Overall length with rotors turning was 20.962 m (68 ft 9⁹⁄₃₂ in) and the helicopter was 5.593 m (18 ft 5⁷⁄₁₆ in) high; the main rotor diameter was unchanged at 21.0 m (68 ft 10⁴⁹⁄₆₄ in). The maximum take-off weight was also identical to the Z5's at 7,600 kg (16,755 lb); the maximum forward speed was 192 km/h (119 mph) and maximum range was 651 km (404 miles).



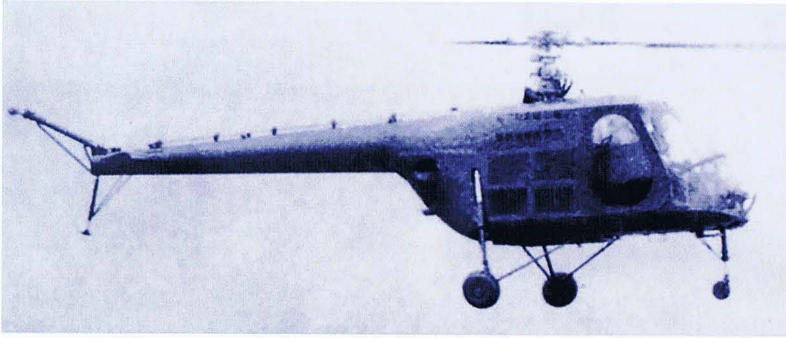


Two Model 701 helicopters survive today. One is preserved at the Nanjing University of Aeronautics & Astronautics (top); the other one is at the PLAAF Museum.

Basic specifications of the Model 701 and Bell 47G helicopters

	Model 701	Bell 47G-3B-2A
Length, rotors turning	13.2 m (43 ft 3¹¹⁄₁₆ in)	13.3 m (43 ft 7½ in)
Height over top of rotor mast	2.83 m (9 ft 3²⁷⁄₆₄ in)	2.84 m (9 ft 3¹¹⁄₁₆ in)
Main rotor diameter	11.32 m (37 ft 1½ in)	11.32 m (37 ft 1½ in)
Maximum take-off weight, kg (lb)	1,300 (2,866)	1,338 (2,950)
Maximum level speed, km/h (mph)	170 (105.6)	169 (105)
Maximum range, km (miles)	350 (217.5)	397 (247)*

* at 6,000 m (13,120 ft) with maximum fuel/no reserves



The Yan'an-2 light helicopter in flight.

Harbin Model 701 light helicopter

In 1965 the Harbin Aircraft Factory started work on a three-seat light utility helicopter designated Model 701. The machine was based on the Bell 47G (H-13 Sioux), featuring the same unmistakable tri-angular-section exposed fuselage truss, 'bubble' cockpit with side-by-side seats, skid landing gear, twin cigar-shaped fuel tanks flanking the rotor mast, two-blade see-saw type main rotor, two-blade tail rotor with a curved rotor guard, triangular ventral fin and low-set stabilisers with endplate fins. Yet the Model 701 was not a straight copy of the Bell 47G. The most noticeable difference lay in the powerplant – the 270-hp Lycoming TVO-435 vertically-mounted flat-six engine was replaced by a 260-hp Zhuzhou Engine Factory HS-6C (Chinese-built Ivchenko AI-14R) nine-cylinder radial mounted so that the crankshaft was disposed vertically. The cockpit had a simplified design with a rather smaller glazing area, and the shape of the fuel tanks was also different.

The helicopter was intended for border patrol, SAR training and liaison. Civil uses included agricultural operations (including pastureland sterilisation), forestry protection and firefighting, fishery survey, geological prospecting, prospecting for construction teams building railroads and highways, high-voltage power line erection and photo survey.

The prototype made its first flight on 23rd January 1970. Upon completion of the tests the Weidong Machinery Factory in Jinan was tasked with series production, building a small number of Model 701s.

A Yan'an-2 in front of the Nanjing Aviation Institute building. Note the bulged cockpit doors.

NPU/NAI Yan'an-2 light helicopter

Also in 1965, the Northwest Polytechnic University started development of an indigenous light helicopter to meet a PLA requirement; later the project was transferred to the Nanjing Aviation Institute, which brought it to fruition. Designated Yan'an-2, the helicopter was a two-seater utilising a conventional layout with a three-bladed main rotor and a two-bladed tail rotor. The fuselage was of semi-monocoque pod-and-boom construction, the tail rotor being mounted on a simplified truss-type pylon at the tip of the circular-section tail-boom which also carried stabilisers with small endplate fins.

The extensively glazed cockpit featured dual controls and was accessed via car-type doors with bulged windows. The cockpit doors and glazing framework, as well as the fuselage/tailboom fairing and stabilisers, were made of composites. The tail rotor blades were likewise made of GRP.

This Yan'an-2 is preserved in the NUAA museum.

Judging by the colour scheme, this is the machine now at NUAA. The angular rear end of the fuselage pod and the simplified tail rotor pylon are evident here.

Again, the engine was an HS-6C mounted in a bay aft of the cockpit, with large cooling air louvers on either side. A tricycle landing gear was used, with pyramidal main units and a strut-braced nose unit.

Two prototypes and a static test article were built; the latter airframe was tested to destruction in 1967. Due to certain technical problems which had to be resolved the Yan'an-2 did not make its first flight until 4th September 1975. In 1983 the original metal main rotor blades were replaced with composite ones. The helicopter did not progress beyond the prototype stage.

The Yan'an-2 was a compact helicopter; the fuselage length was 8 m (26 ft $2\frac{31}{32}$ in) and the main rotor diameter was 10 m (32 ft $9\frac{45}{64}$ in). The maximum take-off weight was 1,155 kg (2,546 lb); the maximum forward speed was 190 km/h (118 mph) and maximum range was 230 km (143 miles).

CHRDI/CAE Z7 heavy transport helicopter

At about the same time CHRDI and the China Aeronautical Establishment made an attempt to fill a vacant niche in China's aviation and create an indigenous heavy helicopter capable of transporting a platoon of troops with full kit. The specification called for a maximum take-off weight of 14,000 kg (30,860 lb), a 3,500-kg (7,720-lb) payload, a top speed of 240 km/h (149 mph), a service ceiling of 6,000 m (19,685 ft) and a range of 350 km (217 miles).

Development work started in 1970. The Z7, as the prospective helicopter was called, featured a conventional layout with a six-bladed main rotor and was designed around two WZ5A turboshafts (a version of the Z6's engine uprated to 2,330 shp). To facilitate production and cut development/production costs the

Troops board a transport-configured PLANAF Z8 serialled '9137'.

A PLANAF Z8 ASW helicopter with radomes on top of the outrigger floats and lateral racks for two torpedoes.

ASW-configured Z8 '9486 White' immediately after departing from a ship.

The same machine (with torpedoes attached) on a ship's helipad.

designers strove to achieve maximum commonality with the Z6 and the production Z5.

By May 1975 two Z7 airframes had been manufactured and 90% of the off-the-shelf systems components and equipment items were available. Static tests were completed successfully in 1979. Meanwhile, the WZ5A began 50-hour bench tests in 1978 and showed good results, meeting the performance target. Yet, the Z7 was in the right place at the wrong time; by then the Chinese aircraft industry was already copying the Aérospatiale Super Frelon naval helicopter as the Z8, and building the Z7 at the same time would have stretched its resources too far. Therefore, the Ministry of Aircraft Industry took the decision to cancel the Z7 programme.

Changhe Z8 heavy helicopter

In the early 1970s the People's Liberation Army Naval Air Force (PLANAF) took delivery of 13 Aérospatiale SA 321Ja Super Frelon amphibious utility helicopters. This large helicopter with a six-bladed main rotor and a five-bladed tail rotor was powered by three 1,630-shp Turboméca Turmo IIIC6-70 turboshafts, two of which were mounted side by side ahead of the main gearbox and the third one aft of it. It had a boat-hull fuselage and rigid outrigger floats carrying the main units of the fixed tricycle landing gear; the utility version had a watertight rear cargo ramp/door in addition to a sliding door to starboard.

Immediately, a decision was taken to reverse-engineer the Super Frelon, and the future Chinese version was designated Z8. CHRDI and the Changhe Helicopter Factory in Jiangxi Province took on the task in 1975; the factory's chief engineer Li Zaijian was in charge of the design effort. At least one of the original French-built helicopters was disassembled for detailed study. Concurrently the Jiangxi Helicopter Engine Factory was tasked with reverse-engineering the Turmo IIIC6-70 and putting it into production as the WZ6. The work began in early 1975 and was headed by Du Jingqing, Yang Ronghua and Chan Shiying; the manufacturing drawings were issued in 1976.

In the late 1970s the Chinese economy was in a state of reform, and the Z8 programme, which had started briskly, was mothballed in 1979 due to financial reasons; the Changhe Helicopter Factory funded the continuation of the work on a small scale, using revenue from civil product sales. In June 1984 Prime Minister Zhao Ziyang ordered a reactivation of the programme. In the meantime, the WZ6 turboshaft had passed preliminary bench tests in 1980 and 500-hour service life tests in 1982, being cleared for installation in the helicopter.

The prototype Z8 successfully made its first free flight at the factory's Lumeng airfield in Jingdezhen on 11th December 1985. Production began soon afterwards and the type achieved initial operational capability with the PLANAF in 1989, finally receiving its design certificate in 1994. Production continued at a low rate (two or three per year) in the 1990s; the Z8 was the largest and heaviest helicopter built in China. Early Z8s lacked the French version's Sylphe weather radar in a thimble nose radome, having a smooth nose profile. The radar was added later.

The Z8 had a crew of two. On transport missions it could carry 27 troops with full kit (or a maximum of 39 soldiers). In medevac configuration the cabin could be outfitted for 15 stretcher patients and a medical attendant. For maritime search and rescue mission the Z8 could carry two inflatable life rafts. Also, an electric hoist with a capacity of 275 kg (606 lb) was fitted as standard above the starboard side door and could be used with a rescue basket for picking up people in distress.

The helicopter could operate not only from shore bases but also from the helipads of the Chinese Navy's *Luhu* and *Lu-ta* class destroyers and supply ships.

The prototype of the Z8A army version. Note the lack of stabilising floats.

The only known export customer for the type is Sudan; the Sudanese Air Force bought an unspecified number of Z8s.

Z8 ASW/ASV/MCM version

Early PLANAF Z8s filled the transport and logistic supply roles. In due course, however, the Changhe Aircraft Industry Corp. brought out an anti-submarine warfare (ASW) and anti-surface vehicle (ASV) version similar to the French Navy's SA 321G. This variant had a search radar with two antennas in drum-shaped

Production Z8As on the ground and in flight. Unlike the prototype, they have stabilising floats and a weather radar.

A utility-configured naval Z8 shows the starboard side rescue hoist and the open hatch for the external sling hook.

housings on top of the stabilising floats and a Thomson Sintra HS-12 dunking sonar.

The helicopter could carry two ASW torpedoes on pylons fitted to the fuselage sides. The torpedoes are variously reported as ET52 (a Chinese copy of the Italian A.244S Whitehead torpedo) or Yu-7 (a Chinese copy of the US Mk 46 torpedo). For ASV missions, eight 250-kg (551-lb) anti-shipping mines could be carried. Plans were also in hand to arm the Z8 with YJ-81K (C-801K) or YJ-82K (C-802K) anti-shipping missiles.

This version of the Z8 could also be outfitted for mine countermeasures (MCM), towing a mine-clearing sled at a speed of 46 km/h (28.5 mph) for up to two hours.

Z8A army transport helicopter

The Changhe Aircraft Industry Group (CHAIG) also developed a land-based transport version designated Z8A for the PLA in the mid-1990s. This version had different engines (Turboméca Makila 2A turboshafts) mated to the existing main gearbox. The prototype (c/n Z8A-00) differed from the naval versions in that it lacked the stabilising floats and had a simplified main landing gear design (the oleos were attached to pairs of hinged V-struts).

The helicopter received its design certificate in February 1999, two examples being delivered to the Army Aviation Corps in 2001 for evaluation. The first production batch of Z8As was reportedly delivered in November 2002. Surprisingly, the production examples reverted to the stabilising floats, differing outwardly from the basic naval version only in wearing a three-tone army camouflage scheme; some have a weather radar fitted.

Z8F transport helicopter

In order to give the good old Z8 a new lease of life the Changhe Aircraft Industry Corp. developed a new amphibious utility designated Z8F. The original WZ6 engines gave place to three 1,877-shp Pratt & Whitney Canada PT6A-67B turboshaft engines; an auxiliary power unit was installed aft of the rear engine. The additional 912 shp of aggregate engine power expected to enhance 'hot-and-high' performance, including an increase in the hovering ceiling to 4,700 m (15,420 ft) at MTOW and increased payload capacity. Other improvements reportedly included new composite main rotor blades with electric de-icing, as well as new avionics and mission equipment.

The new variant was announced at Airshow China 2002 in Zhuhai in November 2002. The maiden flight was slated for the second quarter of 2004 but had to be postponed when the engines were returned to Canada for modification. The engines were finally reinstalled in mid-2004, the prototype (c/n Z8F-00) making its first flight in August 2004. Outwardly the Z8F differed from the original version in having a more streamlined engine housing with flush air intakes closed by wire mesh and smaller, neater engine exhaust pipes curving backwards.

Z8K CSAR helicopter

A specialised combat search and rescue (CSAR) version of the Z8 was developed for

Z8 specifications

Length, rotors turning	23.05 m (75 ft 6⅝ in)
Height, rotors turning	6.66 m (21 ft 10¹³⁄₆₄ in)
Width	5.2 m (17 ft 0¾ in)
Main rotor diameter	18.9 m (62 ft 0 in)
Empty weight, kg (lb)	6,983 (15,395)
Normal take-off weight, kg (lb)	9,000 (19,840)
Maximum take-off weight, kg (lb)	
with standard fuel	10,592 (23,350)
with two auxiliary fuel tanks	13,000 (28,660)
Maximum payload, kg (lb)	
internal	4,000 (8,820)
externally slung	5,000 (11,020)
Maximum speed, km/h (mph)	315 (195)
Cruising speed, km/h (mph)	266 (165)
Economical speed, km/h (mph)	255 (158)
Service ceiling, m (ft)	6,000 (19,685)
Hovering ceiling, m (ft):	
in ground effect	5,500 (18,040)
out of ground effect	4,400 (14,440)
Ferry range, km (miles)	830 (515)
Combat radius with a 3,000-kg (6,610-lb) payload, km (miles)	500 (310)
Endurance (with maximum fuel and two engines running)	2 hours 30 minutes

the PLAAF. Designated Z8K, the helicopter featured a powerful searchlight and a gyrostabilised optoelectronic (TV/thermal imaging) system in a small 'ball turret' under the nose. The helicopter also sprouted additional ventral blade aerials; this suggested the installation of a receiver allowing the Z8K to zero in on an emergency transmitter activated by downed aircrew. The new version was first seen operational with the PLAAF in 2007.

The Z8F prototype. The differently shaped engine intakes and exhausts are evident.

'30771 White', the second example of the Z8K CSAR helicopter (c/n Z8K-01). Note the under-nose optoelectronic 'turret' and the ventral aerials.

China Flying Dragon Airlines Z9A B-7112 represents the law enforcement version (note the loud-hailer). Note also the policeman in the cabin photographing the photographer, who would be well advised to get away quick!

Harbin Z9 family

Z9 Haitun multi-role helicopter

On 2nd July 1980 the Chinese government signed a licensing agreement with Aérospatiale to produce the SA 365N Dauphin II helicopter. This was a twin-engined machine with a retractable tricycle landing gear, a four-blade main rotor and a 13-blade fenestron ('fan-in-fin' assembly) for torque compensation/directional control. The cabin accommodated 10 persons, including the pilot, and was accessed via three forward-hinged doors on each side.

A manufacturing licence was also bought for the helicopter's 710-shp Turboméca Arriel IC1 turboshaft. The agreement provided for the manufacture of an initial batch of 50 machines and 100 engines to power them.

B-7106 represents the maritime SAR version of the Z9A, as indicated by the powerful rescue hoist and the emergency flotation gear.

An SA 365N registered F-WXFY was supplied to China as a pattern aircraft for series production, which was to take place at the Harbin Aircraft Manufacturing Company (HAMC). The Arriel IC1 engine was to be produced by SAEC at Zhuzhou as the WZ8A. The Harbin Engine Factory was responsible for manufacturing the drive train, while the rotor blades were subcontracted to the Baoding Propeller Factory. In China the Dauphin II was redesignated Z9 and its original French name (meaning 'dolphin') was translated directly into Chinese as Haitun.

The first batch of 28 aircraft was assembled entirely from French-supplied CKD kits; such helicopters conformed to the SA 365N1 standard and were designated simply Z9. Bearing PLAAF markings but no serial, the first locally assembled example (c/n Z9-0001) took to the air in 1981.

LH98267, a Z9W, flies at ultra-low level. Note how far the ATGMs are placed from the fuselage.

Z9A multi-role helicopter

The next 20 helicopters manufactured under the licensing agreement were equivalent to the SA 365N2 and were designated Z9A. These aircraft incorporated a number of Chinese-made components; the last of them was completed in January 1992. One of the prototypes (B-572L, c/n Z9A-0100) was displayed at Airshow China '96.

This Z9W is armed with 18-tube FFAR pods carried on shorter outriggers.

Z9W LH99952 shows its roof-mounted sight working with the ATGMs.

On-deck maintenance of a PLANAF Z9A.

Z9W LH98960 is armed with FFAR pods in this case.

A Z9W of the 9th Army Aviation Regiment (LH99948) with a machine-gun on the starboard side.

Z9A-100 (Z9B) multi-role helicopter

Gradually the Chinese aircraft industry mastered production of the helicopter. On the next two examples, initially bearing the designation Z9A-100, the share of locally manufactured components reached 72.2% in the airframe and 91% in the powerplant (production of the WZ8A was mastered in 1986). The first of these made its maiden flight on 16th January 1992; certification tests were completed at the end of the year and in 1993 the Z9A-100 entered production as the Z9B. It differed from the Z9A in having WZ8A engines uprated to 740 shp and a modified fenestron with 11 wider-chord, all-composite blades instead of the original version's 13 all-metal blades.

The Z9B entered PLA service in 1994. The production rate was slow; a total of 25 had been ordered by 1997, and a further seven in 1998. Originally the Z9B was used as a troopship, carrying up to eight troops. However, due to the availability of Mi-17 and Mi-171 helicopters (supplied by Russia after the normalisation of Sino-Russian relations) which were more capable troopships, the Z9B was reassigned to such missions as SAR, reconnaissance and liaison. In case of need it could be fitted with rocket pods and podded machine-guns. The Z9B is the most numerous version, with over 100 examples delivered; it was the first version to be exported, two armed examples being delivered to the Mali Air Force in June 2000.

The second prototype Z9W (above) and a production Z9WA fire HJ-8 tube-launched anti-tank guided missiles.

Z9C (Z9EC?) shipboard ASW/ SAR helicopter

The PLANAF took delivery of eight SA 365MA shipboard helicopters optimised for ASW and SAR operations. (Some sources, however, state the French original as the later AS 565SB Panther helicopter.) The machine had an Agrion 15 X-band search radar in a tablet-like undernose radome, a Thomson Sintra HS-12 dunking sonar and weapons outriggers on the fuselage sides. Hence the Harbin Aviation Industry Group (HAIG) was tasked with manufacturing a local version of this helicopter known as the Z9C (the designation Z9EC has also been reported).

The Z9WA night-capable attack version with a YY-1 optronic nose 'turret'. The crew is provided with night-vision goggles.

The shape of the Z9WA's weapons outriggers and nose adapter carrying the optronic turret are clearly visible here.

The Z9W with a selection of weapons, including FFARs, heavy machine-guns and ATGM.

LH98970, a Z9WA of the 8th Army Aviation Regiment, with FFAR pods.

The flight line of the 8th AAR at Hebei, with a mix of Z9Ws and Z9WAs.

The Z9C could carry a single ASW torpedo (as in the case of the Z8, the weapon has been variously reported as a copy of the Italian A244 Whitehead or the American Mk 46 Mod. 1). Some examples were fitted with a KLC-1 search radar (the Chinese version of the Agrion 15) and data link; they could be used for over-the-horizon targeting, relaying guidance commands from a cruiser to a YJ-83 (C-803) surface-to-surface missile. Plans were in hand to upgrade the helicopter by integrating C-701 TV-guided anti-shipping missiles.

The Z9C operated from the PLA Navy's Type 052 (*Luhu* class) and Type 051B (*Luhai* class) destroyers, as well as Type 053H2G (*Jiangwei* class) and Type 053H3 (*Jiangwei II* class) frigates. With the advent of the Kamov Ka-28 ASW helicopters supplied by Russia, which took up residence on the destroyers, the Z9C is likely to be relegated to the smaller ships.

Z9A C² artillery spotting helicopter

A command post version of the Z9A for artillery fire direction is reported to be in existence. The reported designation is Z9A C² (command and control).

Z9W (WZ9) attack helicopter

In the mid-1980s HAIG began developing an armed version of the Z9 in response to the PLA's urgent requirement for a strike helicopter. The new variant received the designation Z9W, although some sources called it WZ9 (*Wuzhuang Zhishengji* – attack helicopter).

A PLANAF (6th Independent Regiment) Z9C carrying a torpedo.

The shape of the Z9C's nose housing a KLC-1 radar is clearly visible here.

Two tubular outriggers were mounted on the fuselage sides between the second and third pairs of doors, with single pylons at the tips; each could carry an inverted-T shaped adapter mounting two Norinco HJ-8 or HJ-8E (*Hongjian* – Red Arrow) tube-launched wire-guided anti-tank guided missiles. Thus the Z9W was the first Chinese helicopter capable of destroying armoured targets. The weapon had a launch range of 0.6-3 km (0.37-1.86 miles) and could penetrate armour plate up to 600 mm (23⅝ in) thick. The ATGMs were guided by means of a gyrostabilised optical sight mounted on the cabin roof, offset to port.

Unlike the basic Z9A, the helicopter featured armour protection against small-arms fire. The Z9W was powered by the same

Z9C '9625 Black' on the helipad of a destroyer. As this view shows, the weapons rack was on the port side only.

Deck hands prepare to hook up a torpedo to Z9C '9666 Black'.

As these photos show, different examples of the Z9C were fitted with different radars.

WZ8A engines without any IR signature suppression, such as exhaust/air mixers.

The first prototype (c/n Z9W-01) first flew in 1987. The second prototype (c/n Z9W-02) was serialled '043 Black'. The first live missile test launches by the Z9W took place in 1989. Small-scale production began shortly afterwards, and the helicopter entered PLA Army Aviation Corps service, about 80 being delivered. Other weapons options added after service entry were 18-tube pods with 57-mm FFARs, nine-tube pods with 90-mm FFARs, two 12.7-mm machine-guns or 23-mm cannons, and up to four TY-90 short-range IR-homing AAMs with a range of 6 km (3.73 miles). When armed with TY-90 AAMs the Z9W could attack other helicopters.

Z9WA attack helicopter

The standard Z9W was capable of daylight operation only. To remedy the situation the Luoyang Electro-Optics Technology Development Centre (EOTDC) designed the YY-1 gyrostabilised electro-optical targeting system comprising low-light level TV (LLLTV) and infrared search & track (IRST) equipment. This was mounted in a large hemispherical turret under a lengthened and reshaped nose fairing, making the helicopter capable of night and poor-weather operations. The image generated by the EO targeting system was presented on two large multi-function displays on the instrument panel; there was also a third, smaller display.

Designated Z9WA, the night-capable version was heavier than the standard Z9W. This was both due to the new avionics and to the fact that the number of ATGMs was doubled to eight. Therefore the helicopter was powered by uprated WZ8C turboshafts (equivalent to the Turboméca Arriel 2C) delivering 860 shp for take-off. The Z9WA entered service in 2005.

A brand-new Z9G undergoes power-on tests at Harbin. The different fuselage design with wide cockpit doors and no rear cabin doors is evident.

A Z9G with neat four-packs of ATGMs on the weapons outriggers.

DZ9 ECM helicopter

This is the reported designation of a communications jamming version (also reported as the Z9EW).

Z9G attack helicopter

This helicopter was based on the Eurocopter SA 565, featuring a new fuselage with much wider forward (cockpit) doors. The number of doors was reduced to four, the rearmost pair being deleted due to installation of weapons outriggers. The latter could carry eight ATGMs and other external stores. Like the Z9WA, the Z9G was night-capable, featuring a similarly shaped nose with an optronic 'ball turret' underneath.

Z9-H410A commercial helicopter

Trying to meet the needs of the commercial aviation market, HAIG launched a series of civil versions of the Z9. The first of these was the Z9-H410A (often shortened to simply H410A) brought out in 2001; the figures in the designation referred to a maximum TOW of 4,100 kg (9,040 lb). It is powered by WZ8A engines and featured an elongated nose radome (similar to that of the Z9C) and three pairs of wide doors; the rearmost pair of cabin doors was aft-sliding.

This camouflaged Z9 serialled WJ003 (c/n Z9-0202) is one of at least four operated by the Xinjiang Police Department (note the loudhailer).

Specifications of the Z9 family

	Z9/Z9A	Z9B	Z9W	H410A	H425
Flight crew	1	1	2	1	1-2
Maximum passengers	9	9	–	13	12-13
Main rotor diameter	11.93 m (39 ft 1¾ in)	11.93 m (39 ft 1¾ in)	11.93 m (39 ft 1¾ in)	11.93 m (39 ft 1¾ in)	12.00 m (39 ft 4 7/16 in)
Length (rotors turning)	13.46m (44 ft 2 in)	13.46m (44 ft 2 in)	13.46m (44 ft 2 in)	13.46m (44 ft 2 in)	n.a.
Fuselage length	11.44 m (37 ft 6½ in)	11.44 m (37 ft 6½ in)	11.44 m (37 ft 6½ in)	11.44 m (37 ft 6½ in)	12.04 m (39 ft 6 in)
Height overall	4.01 m (13 ft 2 in)	4.01 m (13 ft 2 in)	4.01 m (13 ft 2 in)	4.01 m (13 ft 2 in)	3.97 m (13 ft 0 19/64 in)
Empty weight, kg (lb)	1,975/2050 (4,354/4,520)*	2,050 (4,520)	2,050 (4,520)	2,050 (4,520)	n.a.
MTOW, kg (lb)	3,850 (8,490)	4,100 (9,040)	4,100 (9,040)	4,100 (9,040)	4,250 (9,370)
Max payload, kg (lb):					
internal	1,900 (4,190)	1,900 (4,190)	2,038 (4,493)	1,900 (4,190)	2,090 (4,610)
slung	1,600 (3,530)	1,600 (3,530)	1,600 (3,530)	1,600 (3,530)	1,600 (3,530)
Max speed, km/h (mph)	305km/h	305km/h	315km/h	n.a.	n.a.
Cruising speed, km/h (mph)	250-260 (155-161.5)	250-260 (155-161.5)	280 (174)	160-280 (99-174)	260-280 (161.5-174)
Service ceiling, m (ft)	4,500m	4,500m	4,220 m	4,570m	6,000m
Hovering ceiling, m (ft):					
in ground effect	1,950 (6,400)	2,600 (8,530)	2,600 (8,530)	2,150 (7,050)	2,670 (8,760)
out of ground effect	1,020 (3,350)	1,600 (5,250)	1,600 (5,250)	1,150 (3,770)	1,320 (4,330)
Range, km (miles):					
standard	n.a.	n.a.	664 (412)	860 (534)	800 (496)
with auxiliary tank	1,000 (621)	1,000 (621)	n.a.	1,000 (621)	n.a.
Endurance	5 hours	5 hours	n.a.	n.a.	n.a.

* Z9/Z9A

In April 2001 the H410 received the domestic type certificate and production certificate. It is used for passenger and VIP flights, cargo transportation (including carriage of slung loads), offshore support, emergency medical services and forestry patrol. If appropriate mission equipment is installed, it can be used for SAR, law enforcement (police and coast guard/maritime patrol operations) etc. For example, a version for the Chinese Coast Guard (or possibly Customs) is fitted with a powerful searchlight under the nose, an opto-electronic system in a gyrostabilised 'ball turret' suspended from a port side outrigger, and emergency flotation gear.

A Z9-H425 serialled GA-320101 (c/n Z9-0253) in service with the Chinese police. Note the searchlight on the port side of the nose and the loudhailer.

Z9-H425 commercial helicopter

A much-improved version designated Z9-H425 (or simply H425) to indicate an MTOW of 4,250 kg (9,370 lb) appeared in 2005. It was based on the SA 565, featuring the same elongated 'duck bill' radome and three pairs of wide doors (the rearmost pair was aft-sliding). The helicopter was powered by 850-shp Turboméca Arriel 2C engines and featured an electronic flight instrumentation system supplied by Rockwell Collins, with five colour liquid-crystal displays and a control/display unit. The airframe and rotor system were re-stressed for a higher gross weight and the fuel system incorporated crashworthy features.

Registered B-659L and wearing an overall blue demonstrator colour scheme, the H425 prototype first flew in December 2003. The basic passenger version seats up to 14, including one or two pilots. As in the case of the H410, VIP, EMS, SAR and law enforcement configurations are offered.

Z9-H450 commercial helicopter

This version currently under development features an MTOW increased to 4,500 kg (9,920 lb) and a higher payload.

B-659L, the H425 prototype, in Harbin Aviation Industry Group demo colours.

Changhe Z11 multi-role helicopter

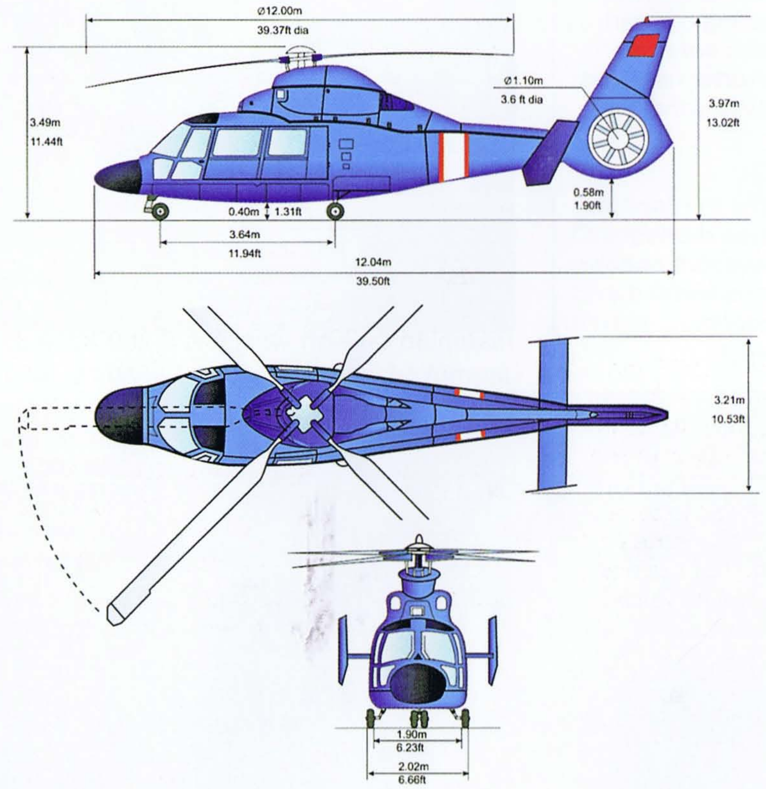
In 1989 the CHRDI and the Changhe Helicopter Aviation Industry Group started work on a multi-purpose light helicopter designated Z11. This was another clone of a French design – in this case, the Aérospatiale AS 350B Ecureuil (Squirrel), aka AStar; a few second-hand AS 350Bs had been purchased in the USA, apparently for the purpose of reverse-engineering. This was a six-seat helicopter with a skid landing gear powered by a single 684-shp Turboméca Arriel ID turboshaft and having a three-blade main rotor and a two-blade tail rotor.

(Incidentally, later CHAIG stated that 'China owns its independent intellectual property rights in the helicopter'. But then, the Chinese are notorious for claiming copied designs as 'completely indigenous' – even when the product's foreign origins are patently obvious, and this is not limited to aircraft.)

True enough, the Z11 was not a 100% 'carbon copy' – some design changes were indeed made. The most obvious one was a 'nose job' – the Chinese helicopter had a more elongated nose incorporating a hinged nosecone that offered space for an optional weather or guidance radar.

The first prototype (c/n Z11-0001) performed its maiden flight on 16th December 1994, powered by a WZ8D engine (a licence-built Arriel ID). The helicopter gained its type certificate in 1996, and the existence of the Z11 was officially revealed at Airshow China '96 in November. The machine entered low-rate production at the CHAIG plant in Jingdezhen, Jiangxi Province, in 1997 and was supplied to PLA units for use as a liaison, patrol and training helicopter; deliveries began in August 1998.

Civil certification was achieved in 2001. Hence CHAIG is also offering the Z11 to civil customers for such uses as heli-taxi, EMS, SAR and TV broadcasting. So far it is confirmed that China Central Television of Jiangxi Province received one Z11 (registered B-7070) in August 2002; the helicopter has a gyrostabilised TV camera 'ball' on the starboard side of the fuselage.



A three-view of the H425.

The basic Z11 has a fuselage length of 11.24 m (36 ft 10 33/64 in) versus 10.93 m (35 ft 10 5/16 in) for the AS 350B. Overall length with rotors turning is 13.012 m (42 ft 8 9/32 in), main rotor diameter is 10.69 m (35 ft 0¾ in) and

Z11J LH90443 (c/n Z11-0027) of the PLA Army Aviation Training Regiment.

This genuine AS 350 Ecureuil makes an interesting comparison; note the shorter nose and extra windows.

The Z11W prototype shows the weapons outriggers and the roof-mounted sight.

height on ground is 3.14 m (10 ft 3¼ in), though some sources give 3.02 m (9 ft 10⁵⁷⁄₆₄ in). The empty weight is reported variously as 1,120 kg (2,470 lb) or 1,253 kg (2,762 lb); the maximum take-off weight is 2,200 kg (4,850 lb) and the standard fuel load is 423 kg (932 lb). The helicopter has a maximum speed of 261 km/h (162 mph), a cruising speed of 218-238 km/h (135-148 mph) and a range of 600 km (372 miles); the service ceiling is

5,240 m (17,190 ft) and the hovering ceiling in and out of ground effect is 3,700 m (12,140 ft) and 2,930 m (9,610 ft) respectively.

The Z11W prototype makes a demonstration flight.

Z11J training helicopter

The dual-control training version was designated Z11J (*Jiaolianji* – trainer). A small number of these helicopters were delivered to the PLA Army Aviation Training Regiment at Beijing-Tongxian, wearing a striking red/white colour scheme. The trainer version has also been delivered to the Argentinean Army.

Some sources report the Z11J as a public security version (see below).

Z11 public security version

A public security/law enforcement version of the Z11 was brought out, as reported by the Chinese news agency Xinhua in mid-November 2005. The helicopter is equipped with a high-power searchlight, a Breeze-Eastern HS-29700 electric hoist and other mission equipment. Roles include patrol, emergency rescue and disaster relief.

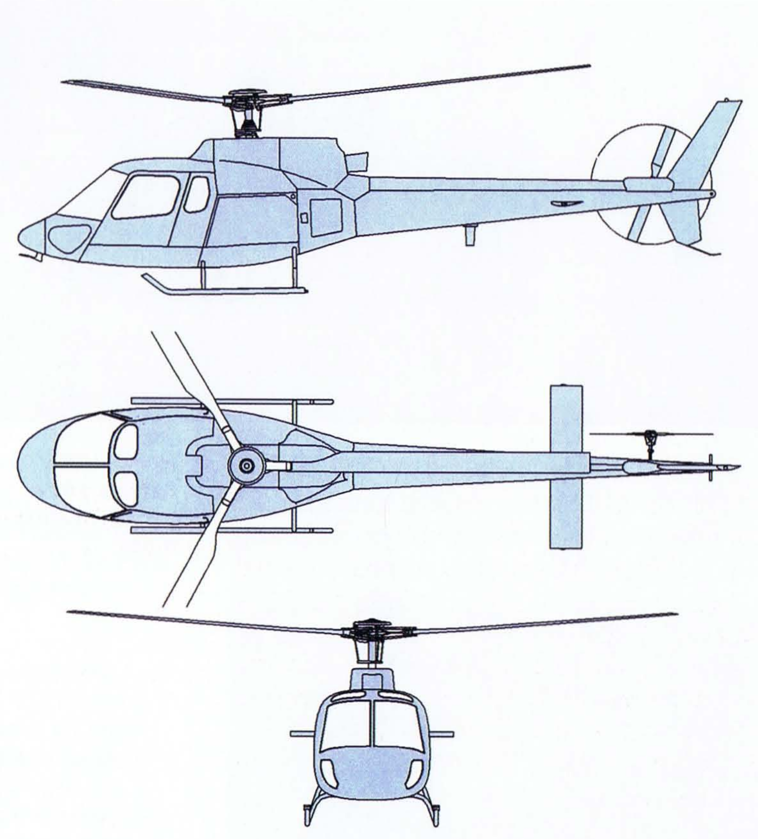
A Z11 in Changhe Aviation Industry Group demonstrator colours.

Z11W attack helicopter

An armed version of the Z11 – the Chinese counterpart of the military AS 350L1 – was brought out in 2004 as the Z11W (*Wuzhuang* – attack). Like the Z9W, it carried four HJ-8 ATGMs or FFAR pods on braced outriggers on the fuselage sides; a stabilised optronic 'turret' was mounted on the cabin roof, offset to port.

The Z11W was unveiled in model form at Airshow China 2002. The prototype (c/n Z11-0001) made its first flight in December that year. In addition to ground attack, the Z11W is intended for battlefield surveillance/reconnaissance and CSAR.

AE350, the first Argentinean Army Z11J (c/n Z11J-0001), seen before delivery.



A three-view of the Z11 multi-purpose helicopter.

Z11-MB1 utility helicopter

A new utility version designated Z11-MB1 entered flight test on 7th March 2003. The helicopter is fitted with a French-made Turboméca Arriel 2B1A turboshaft rated at 860 shp for take-off to give improved 'hot-and-high' performance. The more powerful engine made it possible to increase the service ceiling from 4,500 to 6,000 m (from 14,760 to 19,685 ft). The avionics are also updated; in particular, the Z11-MB1 can be fitted with a GPS navigation set.

Z11N agricultural helicopter

CHAIG is also marketing an agricultural and forestry protection version designated Z11N. A wide, flattened tank for liquid chemicals is located under the fuselage, and spreader bars are mounted ahead of this tank (just aft of the cabin doors). Other mission equipment may be fitted for aerial seeding and for fighting forest fires. The Z11N has a marginally higher MTOW of 2,250 kg (4,960 lb); the cruising speed, service ceiling and hovering ceiling IGE/OGE are also advertised as being higher than the standard version's at 251 km/h (156 mph), 5,270 m (17,290 ft), 4,028 m (13,215 ft) and 3,369 m (11,053 ft) respectively.

Wuhan Helicopter Industry Co.

Back in August 1993 the Wuhan Helicopter Industry Co. (WHIC) was set up under the auspices of the Wuhan local government for the purpose of building various light helicopters designed by the US company Enstrom from CKD kits. The first two piston-engined helicopters (an Enstrom 280FX and a TH-28 trainer) were assembled in 1993; two turbine-engined Enstrom 480s followed in June 1998.

A new factory was erected at a 'green field' site and commissioned in 1998, but no production took place there until March 2003. The new plant not only assembled helicopters from US-supplied kits but also manufactured some of the components locally. The Enstrom helicopters manufactured by WHIC were mostly used for forestry patrol.

A computer-generated image of the Z11N agricultural helicopter in action.

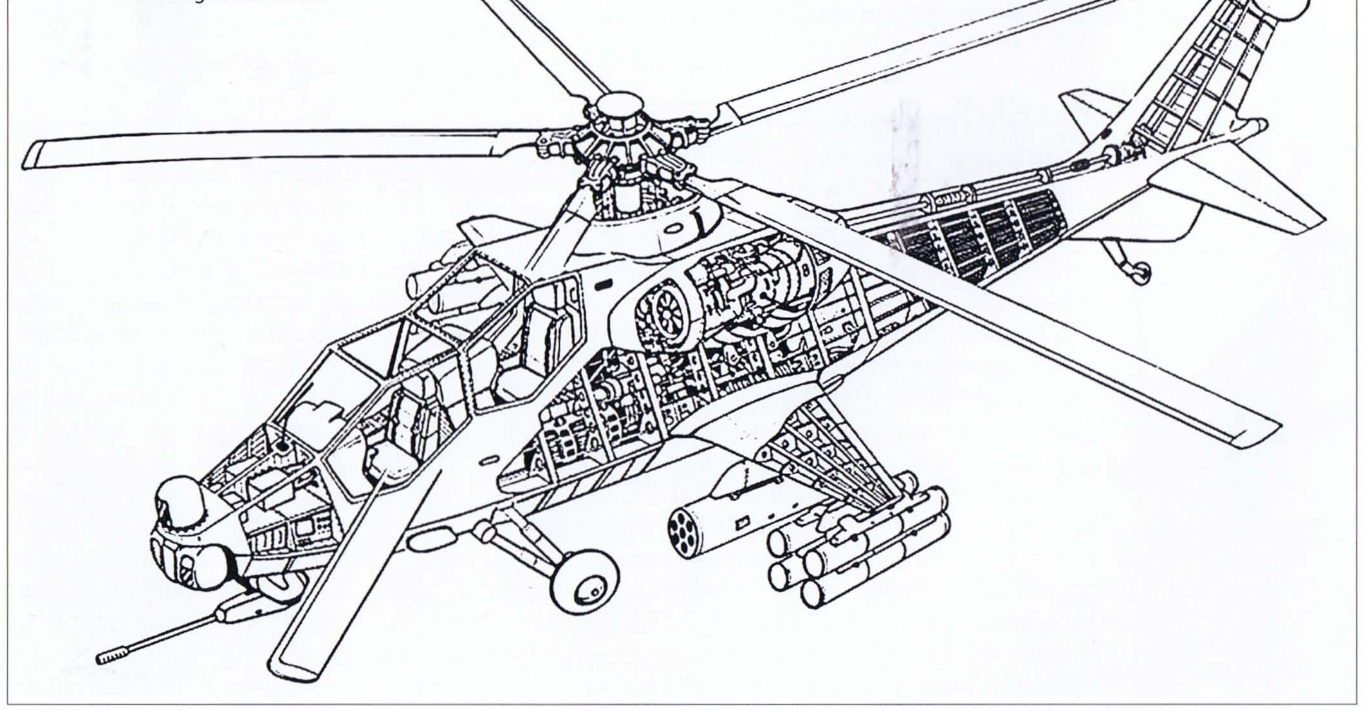
The first prototype WZ10 had a differently shaped nose and upward-pointing exhausts.

CHRDI Z10 multi-role helicopter (project)

In 1994 the CHRDI joined forces with the Nos. 602 and 608 Research Institutes to develop a fast multi-role helicopter comparable in size and weight to the Agusta A 109 and the Sikorsky S-76. The programme quickly gained international status: on 15th May 1997 Eurocopter France (formerly Aérospatiale) signed a US$ 70-80 million contract under which it was to assist in developing the rotor system. Agusta (now part of AgustaWestland) followed this example in 1999, signing a US$ 30 million deal to develop the drive train (main and tail gearboxes). AgustaWestland introduced the provisional designation CMH (Chinese Medium Helicopter) in July 2000.

An artist's impression of the CMH showed a machine looking like a stretched A 109, with a streamlined fuselage tapering aft of the cabin, a retractable landing gear and four large cabin windows per side; the helicopter had a five-bladed main rotor and a six-bladed tail rotor mounted at the top of a swept fin, which was augmented by a triangular ventral strake. The powerplant was defined in 2001 as a pair of 1,700-shp Pratt & Whitney Canada PT6C-67C turboshafts. The seating capacity was to be two pilots and up to 14 passengers or troops; the MTOW was originally set at 5,500 kg (12,130 lb) but then changed to 6,000 kg (13,230 lb).

Later the project received the official Chinese designation Z10 – thus creating confusion with the WZ10 attack helicopter described in the next entry. The mystery was



A provisional cutaway drawing of the WZ10.

Right and below right: The third WZ10 prototype (c/n Z10-03) shows the engine exhaust pipes pointing at right angles to the fuselage axis.

resolved eventually when a model of the Z10 was displayed at Airshow China 2006 in November that year. The Z10 was a commercial and military transport helicopter sharing the powerplant, drive train and rotor system of the WZ10. It turned out to be rather different from the artist's impression; the 'real thing' bore a striking resemblance to the Sikorsky S-70 (UH-60 Black Hawk), featuring a non-retractable tailwheel undercarriage and a squashed-X low-noise tail rotor.

The Z10 is expected to make its first flight in 2009 and achieve certification in 2012. Both civil and military uses are envisaged; among other things, the PLA Army Aviation Corps intends to put the basic transport/utility version into service in 2015-2020, and an ASW/SAR version for the PLANAF may follow.

CHRDI/Changhe WZ10 attack helicopter

Although the Z9W (WZ9) did provide the PLA Army Aviation Corps with a much-needed anti-armour capability, it was ill suited to the requirements of modern warfare. It had inadequate armour protection, inadequate protection against surface-to-air missiles and a high visual signature, all of which made it vulnerable to enemy air defences over the battlefield. Hence in 1998 the PLA formulated a requirement for a state-of-the-art attack helicopter – primarily a tank-buster with a secondary counter-air capability.

Again, the CHRDI and the Changhe Helicopter Aviation Industry Group joined forces to create a modern battlefield helicopter designated WZ10. Development proceeded under tight security, so very little information about the project is available.

While not being a copy of any existing design, the WZ10 embodies the same basic concept as several existing attack helicopters, such as the American Boeing (née Hughes) AH-64 Apache, the Italian Agusta A129 Mangusta, the Soviet/Russian Mil' Mi-28, the Franco-German Eurocopter EC 665 Tiger and the South African Denel (Atlas) CSH-2 Rooivalk. It uses a conventional single-rotor layout with a five-blade main rotor and a four-blade tail rotor. The fuselage is narrow in order to minimise the likelihood of being hit from a head-on angle and features two cockpits in a stepped-tandem arrangement, the pilot sitting

aft of and above the weapons systems operator. The helicopter has a crashworthy non-retractable tailwheel landing gear. The cockpits, engines and vital systems components are armour-protected.

The powerplant comprises two turboshafts mounted high on the centre fuselage sides to preclude them being disabled by a single hit. The engine type remains unconfirmed. There have been reports that Pratt & Whitney Canada PT6C-67C engines have been used, although some sources suggest the WZ10 is powered by MTU/Rolls-Royce/Turboméca MTR 390 turboshafts with a 1,285-shp take-off rating and a 1,556-shp contingency rating. The engines have exhaust/air mixers to reduce the helicopter's IR signature.

Stub wings are provided for carrying up to eight ATGMs and other weapons; additionally, a 30-mm cannon with large traversing/elevation angles is mounted in a chin turret. The type of missiles is unknown; some sources suggest these are HJ-9 tube-launched wire-guided weapons comparable to the US TOW missile. China is said to have been developing the new HJ-10 ATGM comparable to the American AGM-114 Hellfire for the WZ10, but this remains unconfirmed. IR-homing short-range AAMs can also be carried.

The helicopter's mission avionics include an electro-optical sighting system and a satellite navigation system. Reports indicate that the WZ-10 has a helmet-mounted display/helmet-mounted sight (HMD/HMS) system essentially similar to the US Integrated Helmet and Display Sighting System (IHADSS). The cannon is slaved to this system, allowing the pilots to aim it by looking at the target.

The third (?) prototype WZ10 attack helicopter under test at the CFTE with four-packs of ATGMs on the outer wing pylons.

As many as six prototypes are said to have been built since 2004. These are undergoing extensive tests before the design can be finalised and production approved. Production is to take place at the Changhe plant.

The following estimated figures for the WZ10 have been published: length overall 14.1 m (46 ft 3⁷⁄₆₄ in); main rotor diameter 12.00 m (39 ft 4⁷⁄₁₆ in); height on ground 3.85 m (12 ft 7³⁷⁄₆₄ in); empty weight 5,540 kg (12,210 lb); maximum take-off weight 6,000 kg (13,230 lb); ordnance load 1,500 kg (3,310 lb); maximum speed 270 km/h (mph) or more; cruising speed 230 km/h (mph); service ceiling 6,000 m (19,685 ft); ferry range 800 km (496 miles); rate of climb, more than 10 m/sec (1,970 ft/min).

The fourth prototype (c/n Z10-04) shows differently shaped engine cowlings and exhausts.

A WZ10 prototype fires an anti-tank missile, which is visible immediately ahead of the helicopter's nose.

Shanghai-Sikorsky Shen utility helicopters

In February 2002 the US helicopter manufacturer Sikorsky Aircraft and the Shanghai Little Eagle Science & Technology Co. (SLEC) set up a joint venture called Shanghai-Sikorsky, with SLEC holding 51% of the shares. The purpose of the venture was to commence assembly of Schweizer light helicopters from CKD kits. Three models were built and marketed as the Shen series (named after the river on which Shanghai is located). The first kits were delivered to China in August and assembly began in November.

Shen2B light utility helicopter

The Shen2B was the Chinese-built version of the Schweizer 300CBi helicopter (an extremely utilitarian design that originated as the Hughes 300). The machine was a two-seater and was powered by a Lycoming HO-360-G1A flat-six piston engine. It was intended mainly for training and police patrol.

Shen3A light utility helicopter

This was equivalent to the three-seat Schweizer 300C powered by a Lycoming HIO-360-D1A engine. It was suitable for crop-spraying, as well as for patrol duties.

Shen4T light utility helicopter

The Shen4T was the Chinese version of a newer design – the Schweizer 333. Unlike the 300 model, which looked like little more than a 'bubble' cockpit and a tubular tailboom, it had a more substantial airframe and was powered by a Rolls-Royce (née Allison) 250-C20W turboshaft. Again, the Shen4T was intended for training and law enforcement.

Hongdu MD Helicopters

In early 2003 the US company RDM Holdings established a joint venture with the Hongdu Aviation Industries Group, the partners holding 60% and 40% of the stock respectively. Named Hongdu MD Helicopters (HMDH), the venture was to assemble MD Helicopters MD 500N and MD 600N series light utility helicopters at Nanchang from CKD kits imported from the USA. The helicopters had a five-blade main rotor and utilised the patented NOTAR (NO TAil Rotor) torque compensation/directional control system.

The first kits arrived in March 2003. The programme launch was planned for October 2003 (by which time HMDH had a backlog of about 30 orders), with three MD 500Ns and one MD 600Ns to be completed by year-end. However, only one helicopter, an MD 600N, had been completed by November 2004 and was displayed at Airshow China 2004.

The first two HC 120 helicopters assembled in Harbin (LH90841 and LH90842, c/ns HC120-0001 and HC120-0002) are operated by the PLA Army Aviation Training Regiment.

The Agusta A 109E Power is co-produced in China as the CA 109. This one is in maritime SAR configuration with hoist, searchlight and flotation gear.

Harbin HC 120 multi-role helicopter

The Harbin Aircraft Industry Group has signed an agreement with Eurocopter providing for the assembly of the EC 120 Colibri light utility helicopter. The Chinese-built version is known as the HC 120.

Harbin Z15 multi-role helicopter (project)

Another agreement between the Harbin Aircraft Industry Group and Eurocopter envisaged joint development and production of the EC 175 helicopter. In China the EC 175 will be designated Z15.

Changhe-Agusta CA 109 utility helicopter

In November 2004 AgustaWestland established a partnership with the Changhe Helicopter Aircraft Industry Group (CHAIG) for the purpose of jointly producing the Agusta A 109E Power twin-engined utility helicopter. The new venture, called Changhe-Agusta, is owned 60% by CHAIG and 40% by AgustaWestland. The Chinese-built machines will be redesignated CA 109 to reflect the names of the partners.

Lantian-Mil' Mi-171 transport/utility helicopter

China has long been an operator of the ubiquitous Russian Mil' Mi-8/Mi-17 helicopter (NATO reporting name *Hip*), which has seen service both with the Chinese airline CAAC

Another CA 109 in standard configuration.

A provisional model of the Z15 utility helicopter.

A PLA Mi-17V-5 helicopter with an optronics 'turret' and an apparently 'doctored' serial. A similar version is now being assembled by the Lantian Helicopter Co.

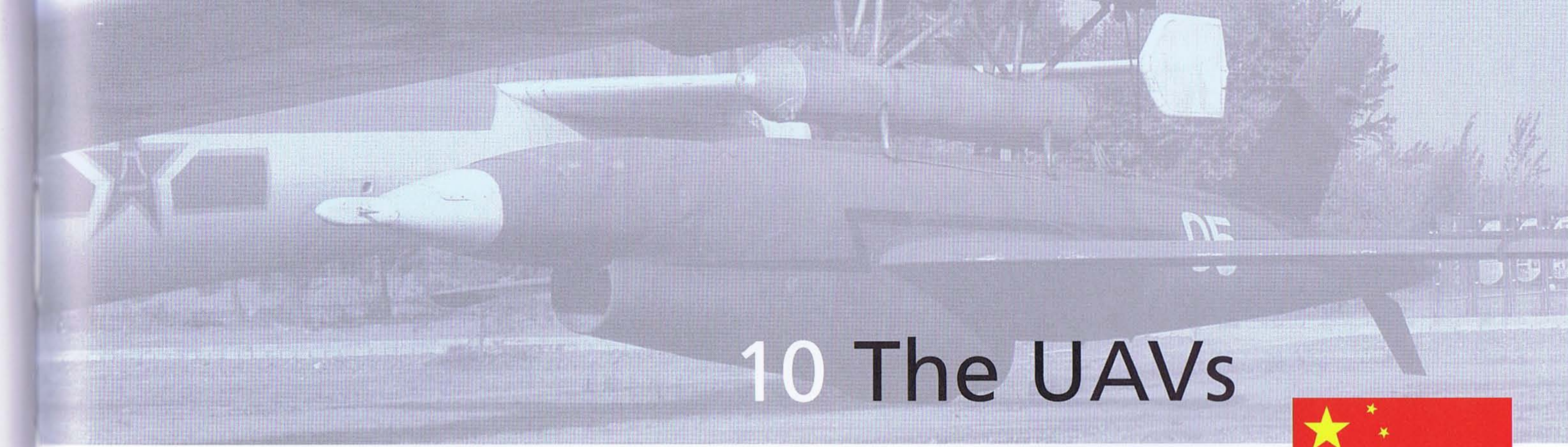
(and some of its successors) and with the PLA Army Aviation Corps. The latter operates one of the latest versions of the *Hip* – the Mi-17V7 featuring a stepped radar nose and a hydraulically powered rear loading ramp/door.

Not content with ordering new Mi-17s from Russia, China decided to set up local production of the type and purchased a manufacturing licence. The Lantian (Blue Sky) Helicopter Company was established in Chengdu, Sichuan Province, for the purpose of undertaking licence production of the Mi-171 (the version of the Mi-8MT currently in production at Ulan-Ude, Russia). Production is to take place at the military repair plant No. 5701; initially the helicopters will be assembled from CKD kits supplied by the Ulan-Ude Aircraft Production Association, but the share of locally produced components is to increase gradually.

The first Chinese-built Mi-171 was test flown in the spring of 2008. The production plans call for 20 helicopters to be assembled before the end of the year; the peak production capacity will be 80 units per year.

The deal has already been criticised as a myopic move in Russia because China plans to export the locally built Mi-171s to Pakistan and African countries, which are among the established customers for Russian arms export. Worse, the need to supply components to China might leave the Russian helicopter manufacturers short of components, which will disrupt deliveries to the burgeoning domestic helicopter market because component suppliers are not in a position to produce more. However, a spokesman for a Russian organisation called Strategy and Technology Analysis Centre said that 'sooner or later China, a nation that is capable of sending a man into space, will copy the helicopter without Russian assistance (read: illegally – *Auth.*) if it wants the helicopter bad enough, so Russia had better participate in the process [and gain some profits] instead of just looking on passively'.

Two more Army Aviation Mi-17s – a Mi-17V-5 of the 2nd AAR and an armed Mi-17V-7.



10 The UAVs

The Chinese aircraft industry also produced a number of unmanned aerial vehicles (UAVs) of varying classes. As was the case with other classes of aircraft built in China, the early models were copies of imported (or captured) UAVs of both Soviet and Western origin, but domestic designs began appearing eventually.

NAI CK-1 drone

For training fighter pilots and anti-aircraft artillery (AAA) crews the PLAAF used Lavochkin La-17 target drones supplied by the Soviet Union in the late 1950s. The La-17 was an all-metal aircraft optimised for high subsonic speeds. The original air-launched version was powered by a Bondaryuk RD-900 ramjet delivering a thrust of 625 kgp (1,380 lbst) at 5,000 m (16,400 ft) and 425 kgp (940 lbst) at 8,000 m (26,250 ft). The later La-17M had a 1,950-kgp (4,300-lbst) Mikulin RD-9BK axial-flow turbojet – a non-afterburning version of the RD-9B which powered the MiG-19 fighter.

As the stock of La-17s was depleted, the worsening of Sino-Soviet relations in 1960 making further deliveries impossible, the need arose to launch domestic production of similar UAVs. It was decided to copy the Soviet design, as had been the case with many Soviet aircraft. The work of reverse-engineering the La-17 commenced in the early 1960s by PLAAF's Weapon Test & Training Base; the effort was headed by General Zhao Xu, who is known as 'the father of the Chinese UAV'. The Chinese version was designated CK-1 (*Chang Kong-1* – Blue Sky-1).

A CK-1C target drone sits among the target drones and towed targets developed by the Nanjing Polytechnical University (NPU).

A CK-1A drone serialled '2037 Black' on its ground handling/launch dolly. The air sampling pods are clearly visible.

The 'Cultural Revolution' had its adverse effect on this highly important programme, causing the work to be halted. It was not until April 1968 that the work resumed – this time at the Nanjing Aviation Institute (NAI); the design process was completed in 1976. Interestingly, the Chinese tried unsuccessfully to copy the RD-900 ramjet and elected to fit a turbojet engine instead – and, as luck would have it, they chose the WP-6, the licence-built version of the RD-9B manufactured in China for the J-6 fighter (the Chinese clone of the MiG-19S) and the Q-5 attack aircraft. A non-afterburning version of the WP-6 was created by converting fighter engines which were nearing the end of their service life and fitted to the drone; thus, the Chinese engineers mirrored the development of the original Soviet drone from La-17 to La-17M. The CK-1 also had a reinforced airframe, revised fuel and electric systems, a Chinese autopilot and a data link system.

An experimental batch of ten CK-1s was built for test and development purposes, and the first test launch took place in October (other sources say on 6th December) 1969. According to available sources, the trials programme was completed in 1976 and the CK-1 was officially included into the PLAAF inventory in March 1977; Chinese sources, however, say design certification was achieved in 1979.

The CK-1 was not a straight copy of the La-17M, having a locally designed autopilot and featuring changes to the airframe and systems (including the fuel system). The typical flight profiles of the CK-1 also differed appreciably from those of the Soviet forebear. Like the La-17MA, the CK-1 was ground-launched, making use of rocket boosters, and was controlled either by a programme entered into the autopilot or by radio commands. A major difference was that the Chinese drone made a rolling take-off, using a three-wheel handling/take-off dolly, which was slowed down by a brake parachute after the drone lifted off. Early variants took off using turbojet power alone and therefore required a fairly long runway to accelerate to lift-off speed; later, the CK-1 was provided with solid-fuel rocket boosters to shorten the take-off run. (By comparison, Soviet ground-launched variants of the La-17 blasted off from a mobile launch ramp.) The CK-1 had a parachute recovery system.

A CK-1C enhanced manoeuvrability target drone with underwing fuel tanks and differently shaped wingtip equipment pods.

Basic specifications of the CK-1

Wing span	7.5 m (24 ft 7$\frac{9}{32}$ in)
Length overall	8.44 m (27 ft 8$\frac{9}{32}$ in)
Height	3.00 m (9 ft 10$\frac{7}{64}$ in)
Wing area, m^2 (sq ft)	8.55 (91.93)
Engine thrust, kgp (lbst)	2,150 (4,740)
Launch weight, kg (lb)	2,060 (4,540)
Maximum speed, km/h (mph)	910 (565)
Maximum range, km (miles)	937 (582)
Service ceiling, m (ft)	18,000 (59,055)
Typical operating altitude	500-5,000 (1,640-16,400)
Endurance, minutes:	
high altitude	45-60
low altitude	70

'2059 Black', a CK-1B target drone. The wingtip pods are again reshaped and aerials have been added under the wings.

CK-1A radiation reconnaissance drone

The first derivative of the CK-1 was the CK-1A intended for radiation reconnaissance in the wake of a nuclear explosion. It was developed in accordance with a government directive issued in March 1977, reflecting the need to replace the manned aircraft used for air sampling missions in nuclear tests. Firstly, the pilot of a manned aircraft was exposed to harmful radiation during such missions; secondly, he was only allowed to enter the tell-tale mushroom cloud a considerable time after the explosion, which meant the samples would not be fresh enough.

The CK-1A featured underwing air sampling pods for radiation reconnaissance. These increased the launch weight to 2,160 kg (4,762 lb); to compensate for this the engine thrust was increased to 2,250 kgp (4,960 lbst).

Three prototypes were built, followed by a number of production examples. The CK-1A was deployed at the Lop Nor nuclear test site in 1977. The first live test in which the CK-1A was used was China's 22nd nuclear test, which took place on 17th September 1977.

CK-1B '9385 Black' is cleared for launch. The people will obviously need to take cover before the engine spools up!

CK-1C '8704 Black' with a test console attached. The meaning of the Roman letters painted all over the place is unknown.

The aircraft was 150 km (93 miles) from the centre of the explosion at the moment of the blast; it made two passes through the mushroom cloud and landed safely.

CK-1B target drone

Development of a new low-altitude version designated CK-1B began in February 1980; it was based on the CK-1A and optimised for training missile crews in destroying low-flying targets. Two 160-litre (35.2 Imp gal) non-jettisonable fuel tanks supplanted the air sampling pods, increasing the fuel load by 240 kg (529 lb); the modified autopilot maintained low-altitude flight automatically, using input from the altimeter.

The CK-1B first flew on 18th May 1982 and was cleared for service in November, entering low-rate production and being formally included into the PLAAF inventory in February 1983.

CK-1C target drone

In May 1983 the NAI started work on the CK-1C, an enhanced manoeuvrability version capable of simulating modern agile combat aircraft with greater realism; the design effort was headed by Lu Qingfeng. The control system was revised to allow the drone to pull relatively high Gs during evasive manoeuvres. The fuel system was also modified to ensure an uninterrupted fuel supply to the engine during sharp manoeuvres (the tanks were pressurised by engine bleed air).

The first two prototypes were completed in July 1984 and entered flight test in September; tests showed that the drone could make 4-G turns. The certification tests involving eight more CK-1C drones took place in February-March 1985.

Details of the CK-1C were made available at the MosAeroShow-92 held at Zhukovskiy near Moscow on 11th-16th August 1992. The drone features two underwing pods with equipment providing an appropriate infra-red signature, as well as five angle reflectors, light and smoke tracers. The main fuel tank is supplemented by two external tanks; some other equipment changes are incorporated. The airframe is virtually identical to that of the La-17M and the WP-6 engine is housed in a lengthened nacelle. A ground launcher is used.

CK-1E target drone

The latest version is the CK-1E designed for ultra-low-altitude tests; it emulates such threats as aircraft and cruise missiles capable of terrain-following flight.

A model of the WZ-5 (Chang Hong-1) reconnaissance drone.

WZ-5 (Chang Hong-1) reconnaissance drone

Despite the similar-sounding name, this was a very different UAV – albeit reverse-engineered as well. As already mentioned in the bomber chapter, a number of Ryan AQM-34N Firebee reconnaissance drones operated by the USAF's Strategic Air Command were shot down after intruding into Chinese airspace during the 1960s. The aircraft, which was optimised for high-altitude photo reconnaissance at high subsonic speeds, had mid-set swept wings and a swept conventional tail, including an all-movable fin supplemented by a small ventral fin. The turbojet engine was located in a ventral conformal pod, with a camera port immediately ahead of the air intake.

The wreckage provided enough material to make an attempt at copying the American drone worthwhile; in 1969 the Beijing Institute of Aeronautics and Astronautics (BIAA) was assigned this task. The Chinese version was designated WZ-5 (*Wuren Zhenchaji* – pilotless reconnaissance; not to be confused with the WZ5 turboshaft engine) and named Chang Hong-1 (Long Rainbow). The design effort, which was undertaken by the institute's UAV section established in 1963, was headed by chief designer Yang Weiming.

The WZ-5 was intended for daylight photo reconnaissance at high subsonic speeds. The camera was installed on a swivelling mount, firing through five camera ports. The powerplant was an indigenous WP11 short-life turbojet – likewise developed by BIAA. The institute was also responsible for the automatic flight control system. The drone had no landing gear, being intended for airborne launch from a heavy aircraft and parachute recovery at the end of the mission.

The first two prototypes were manufactured in 1972. The first flight took place that year; the static tests proceeded in parallel, being completed successfully in October 1972.

A WZ-5 on a handling dolly in a remote corner of the PLAAF Museum.

A WZ-5 under the port wing of the Tu-4 drone launcher at the PLAAF Museum.

Another view of the same drone and the rack on which it is carried.

Probably the same WZ-5 seen from inside the Tu-4 'mother ship'.

The mission equipment (camera) was verified in 1973; high-altitude and medium-range tests followed in 1975. All in all, the flight test programme involved 120 launches of the UAV. In 1976 two more prototypes manufactured entirely of indigenous materials and components were built.

Quite a few development problems were encountered with the engine and the Doppler speed/drift sensor system. A major challenge resolved by BIAA was the development of a combined radio control/tracking/telemetry system which also recorded the necessary flight information. Among other things, a Hawker Siddeley Trident 2 airliner operated by the PLAAF was used as an avionics testbed for the WZ-5's Doppler system.

Certification tests were completed in 1980 and the WZ-5 entered small-scale production in 1981. Originally it was carried aloft by suitably modified Tu-4 bombers refitted with turboprop engines and underwing pylons; later the Shaanxi Y8E acted as the drone launcher. During the mission the WZ-5 was released near the target zone at an altitude of 4,000-5,000 m (13,120-16,400 ft) and automatically climbed to its operational altitude.

The WZ-5 (Chang Hong-1) was 8.97 m (29 ft 5$\frac{5}{32}$ in) long and 2.18 m (7 ft 1$\frac{53}{64}$ in) high, with a wing span of 9.76 m (32 ft 0¼ in). The maximum launch weight was 1,680 kg (3,703 lb). The cruising speed was 800-820 km/h (496-509 mph) and the cruise altitude was in excess of 17,500 m (57,420 ft); the range was more than 2,500 km (1,550 miles). The camera was loaded with 245 m (803 ft) of film.

A Ba-2 target drone on its portable launch ramp; note the rocket booster.

BJ7104 target drone

One of the target drones used by the PLAAF was the BJ7104 – a compact machine powered by a 15-hp piston engine, with an overall length of 2.55 m (8 ft 4$\frac{25}{64}$ in), a height of 0.6 m (1 ft 11⅝ in) and a wing span of 2.7 m (8 ft 10$\frac{19}{64}$ in). The drone had a launch weight of 52 kg (114 lb), including a 10-kg (22-lb) payload, and a top speed of 250 km/h (155 mph); it could operate up to 15 km (9.3 miles) from the command post.

Ba-2 target drone

Starting in the 1960s, the Xian Aisheng Technical Group of the Northwest Polytechnic University (NPU) began developing a series of radio-controlled piston-engined UAVs. One of them was the Ba-2 low-altitude, low-speed drone whose development began in 1966. It was a high-wing monoplane with unswept wings and conventional tail surfaces; the airframe was made largely of glassfibre reinforced plastic (GRP), with some wooden and steel parts, and easily disassembled for transportation. Power was provided by a 14-hp HS-280 flat-four air-cooled two-stroke piston engine driving a two-blade tractor propeller.

The prototype made its first flight in 1968. The Ba-2 entered production in 1970, more than 1,000 examples being delivered to the PLA. Normally the drone acted as a reusable target tug, carrying two sleeve-type targets inside a fuselage bay; the second target was deployed after the first one had been shot to bits. For night training it could be fitted with tracer flares and strobe lights. The drone could also simulate the manoeuvres of fighters and attackers to make the target practice more realistic. A recovery parachute was used at the end of the mission.

The Ba-2 was 2.55 m (8 ft 4$\frac{25}{64}$ in) long and 0.76 m (2 ft 5$\frac{59}{64}$ in) high, with a wing span of 2.7 m (8 ft 10$\frac{19}{64}$ in). The maximum launch

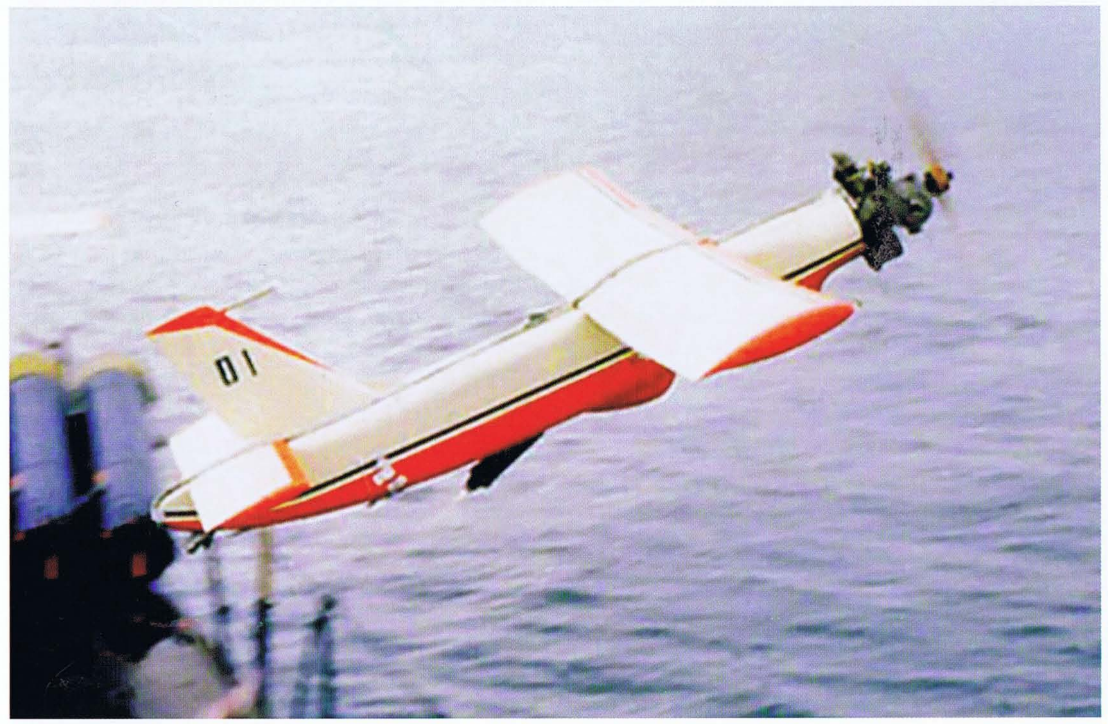
A Ba-7 (ASN-7) target drone on a trailer-mounted launcher. Note the wing pylons for carrying sleeve-type targets.

weight was 53 kg (116.8 lb), including a 5-kg (11-lb) payload and 6 kg (13.2 lb) of fuel. The top speed was 250 km/h (155 mph), the service ceiling was 2,000 m (6,560 ft) and remote control range was 15 km (9.3 miles); the drone had an endurance of 1 hour.

D4 research/survey/reconnaissance UAV

In 1981 NPU began designing the D4 remotely-piloted vehicle intended for aerial survey and physical exploration; it could also be used for short-range photo reconnaissance. Again, the airframe was made of GRP and easily disassembled for transportation, and a 30-hp HS-510 two-stroke flat-four engine developed in house acted as the powerplant. The UAV was launched from a fixed ramp by means of a reusable jettisonable solid-fuel rocket booster, utilising a parachute recovery system for landing, with landing skids and oleo-pneumatic shock absorbers to cushion the impact. Control was automatic until the cruise altitude was reached, whereupon the UAV was radio-controlled.

The first flight took place in February 1982 and certification was achieved in 1983. Normally the D4 was radio-controlled but it could also operate in pre-programmed auto-



A Ba-9 (ASN-9) drone blasts off from a shipboard launcher, showing the rocket booster.

A PLA serviceman prepares to launch an ASN-15 reconnaissance UAV by hand.

pilot mode if a precision flight path was not required.

The D4 was 3.3 m (10 ft 9$\frac{59}{64}$ in) long, with a wing span of 4.3 m (14 ft 1$\frac{19}{64}$ in). The maximum launch weight was 140 kg (308 lb), including a 28-kg (62-lb) mission payload. The radius of action was 40 km/h (24.85 miles).

Ba-6 target drone

A high-altitude, high-speed target drone designated Ba-6 was developed as a derivative of the HQ-2 (Hongqi-2 – Red Banner-2) surface-to-air missile which was a Chinese copy of the Soviet S-75 (NATO codename SA-2 *Guideline*). It was basically the second stage of the SAM equipped with a booster (possibly a ramjet) in a ventral nacelle). The Ba-6 was carried aloft by a modified H-6 bomber.

Ba-7 (ASN-7) target drone

Another model developed by the Xian Aisheng Technical Group was the Ba-7 (alias ASN-7) high-speed target drone – an aircraft with a circular-section fuselage, shoulder-mounted unswept wings and an all-movable butterfly tail augmented by a small ventral strake; the machine was powered by a flat-four engine diving a two-blade tractor propeller. It was launched from a trailer-mounted ramp by means of a reusable solid-fuel rocket booster jettisoned after burnout. The drone was supported by a test equipment van used for checking the aircraft's systems prior to launch, which also towed the trailer.

The ASN-7 could be used in several ways; among other things, it could act as a target tug, carrying two sleeve-type targets on underwing pylons. It could also be outfitted as a reconnaissance UAV with a TV camera and data link equipment for transmitting the TV image to a ground control station in real time.

The UAV is 2.65 m (8 ft 8$\frac{21}{64}$ in) long and 0.57 m (1 ft 10$\frac{7}{16}$ in) high, with a wing span of 2.68 m (8 ft 9$\frac{33}{64}$ in). The operating altitude range was 50-5,000 m (164-16,400 ft), the climb rate 11 m/sec (2,164 ft/min) and the maximum speed 360 km/h (223.6 mph). The ASN-7 had a combat radius of 40 km (24.85 miles) and an endurance of 1 hour.

Ba-9 (ASN-9) target drone

Another target drone in the series, the ASN-9, was developed specially for the People's Liberation Army Navy (PLAN) and intended for shipboard launch. It was an aircraft of normal high-wing layout with a rectangular-section fuselage, constant-chord wings with dihedral outer portions and all-movable tail surfaces comprising a swept fin and unswept stabilators. The engine was a flat-twin driving a tractor propeller; it was augmented by a solid-fuel rocket booster for launch from a fixed ramp on the ship's deck.

Again, the ASN-9 could operate as a reusable target tug, carrying two three-leaf targets deployed consecutively. Once the targets had been expended, the engine would cut and the ASN-9 would parachute to the sea, remaining afloat for subsequent recovery. It could also be used over land, in which case a pair of sprung skids was fitted to cushion the impact on touchdown; a gliding landing or parachute recovery were possible. The drone could also be used as an expendable target for missile launch; in this case it was equipped with a tracer to assist visual tracking.

The ASN-9 was 2.5 m (8 ft 2$\frac{27}{64}$ in) long and 0.72 m (2 ft 4$\frac{11}{32}$ in) high, with a wing span of 2.82 m (9 ft 3 in). It had a maximum speed of 250 km/h (155 mph) and an endurance of 45-60 minutes.

ASN-15 reconnaissance UAV

This man-portable UAV is a low-cost battlefield surveillance system intended for reconnaissance, patrol, and combat search & rescue tasks. The ASN-15 is piston-engined and features a video camera, a data link system and a time registration system; it is launched by hand or from a guide rail, gliding to earth or being recovered by parachute at the end of the mission. The set includes three UAVs, a remote control station and a reception/recording station featuring a display and a video tape recorder.

The overall length is 1.8 m (5 ft 10$\frac{55}{64}$ in) and the wing span 3 m (9 ft 10$\frac{7}{64}$ in); the launch weight is 6.5 kg (14.33 lb) and the operating altitude is 50-500 m (164-1,640 ft). The ASN-15 has a top speed of 90 km/h (56 mph), a combat radius of 10 km (6.2 miles) and an endurance of 1 hour.

ASN-104 reconnaissance UAV

This compact low-altitude, low-speed reconnaissance UAV was developed for the People's Liberation Army's ground forces; the first test launch took place in October 1982 and low-rate production began in 1985. The ASN-104 was similar in overall configuration to the ASN-9 but was powered by a 30-hp HS-510 flat-four engine; the dihedral outer wings had constant taper from root to tip, and the tail surfaces were of trapezoidal planform and conventional design (with inset rudder and elevators). A humpbacked recovery parachute housing was located immediately ahead of the wings, and sprung landing skids were fitted as standard. Launch was by means of a rocket booster.

The ASN-104 formed the core of a battlefield surveillance system including a complement of six UAVs, a mobile command post and a tracking and control station (both based on cross-country lorries). The system ensured surveillance of the battle area and the enemy's rear up to 60-100 km (37-62 miles) from the forward edge of the battle area. The wide-angle TV camera fitted to the ASN-104 allowed the UAV to survey an area of 1,700 km^2 (656.3 sq miles) in one sortie.

ASN-105B reconnaissance UAV

Another tactical reconnaissance system created for the PLA's ground forces was built around the ASN-105B aerial vehicle. This UAV (again powered by an HS-510 engine) is equipped with a gyrostabilised multi-mode optronic system including daylight and low light level TV cameras, ordinary and panoramic still cameras, and infrared linescan equipment. The information is relayed via data link and the UAV features a coordinate determination system allowing the operator to link the image immediately to a spot on the map. Additionally, the UAV has a video recording system of its own. The navigation system uses

An ASN-105 reconnaissance UAV serialled Z-201 is ready for launch.

A computer-enhanced image of the ASN-206 reconnaissance UAV. Note the sensor turret.

both western GPS and Russian GLONASS satellite navigation formats.

The reconnaissance system comprises six UAVs, a mobile launch ramp, a command and control/tracking vehicle based on an army lorry, a test vehicle based on a minibus, a photo imagery processing lab (with a darkroom) and a video imagery processing lab. If necessary, the radio tracking and remote control systems can be detached from the command and control vehicle and become man-portable. The ASN-105B blasts off by means of a rocket booster and is recovered with the help of a parachute.

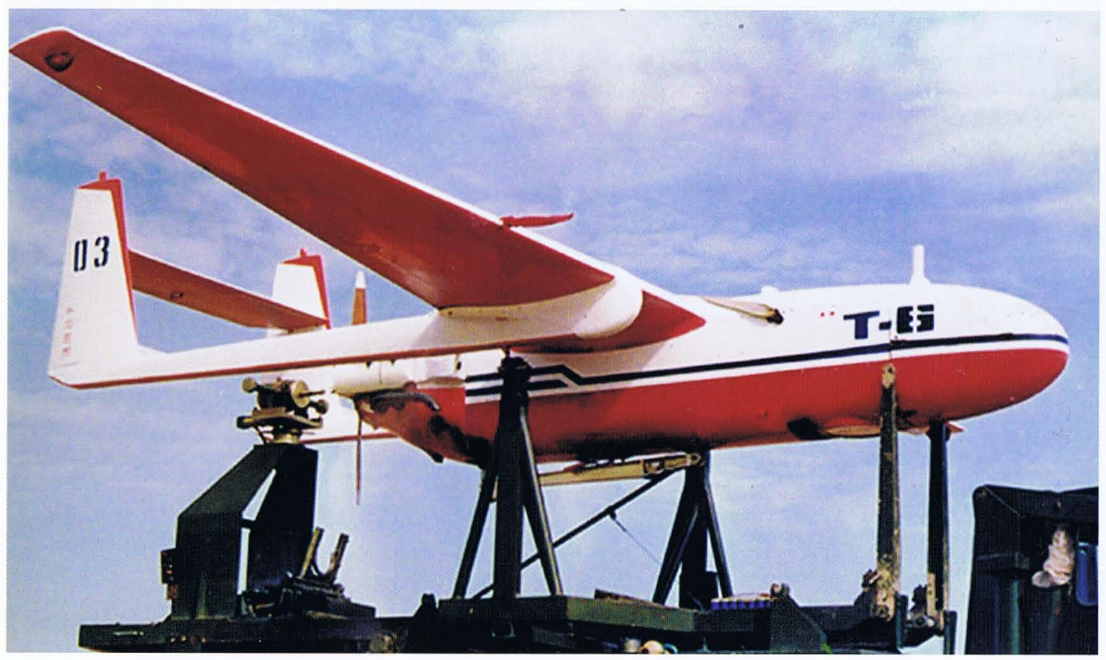
The ASN-105B is 3.75 m (12 ft $3\frac{41}{64}$ in) long and 1.4 m (4 ft $7\frac{7}{64}$ in) high, with a wing span of 5 m (16 ft $4\frac{27}{32}$ in). The launch weight is 170 kg (375 lb) and the mission payload is 40 kg (88 lb). The UAV has a service ceiling of 6,000 m (19,685 ft), a top speed of 200 km/h (124 mph) and a combat radius of 150 km (93 miles) at 2,000 m (6,560 ft); it can stay airborne for 7 hours.

ASN-206 reconnaissance UAV

This compact UAV developed by the Xian Aisheng Technical Group is intended mainly for day/night battlefield reconnaissance, artillery spotting and border patrol. It can also be used for radiation reconnaissance, surveying areas afflicted by natural disasters in the course of search & rescue operations, monitoring pipelines and high-voltage power lines.

The ASN-206 follows the latest trend in the design of unmanned tactical reconnaissance systems, utilising a twin-boom pusher layout with high-set wings and a high-set stabiliser linking the twin fins. The powerplant is a 51-hp HS-700 air-cooled two-stroke flat-four piston engine driving a two-blade propeller. The ASN-206 has no landing gear, being catapult-launched and parachute-recovered.

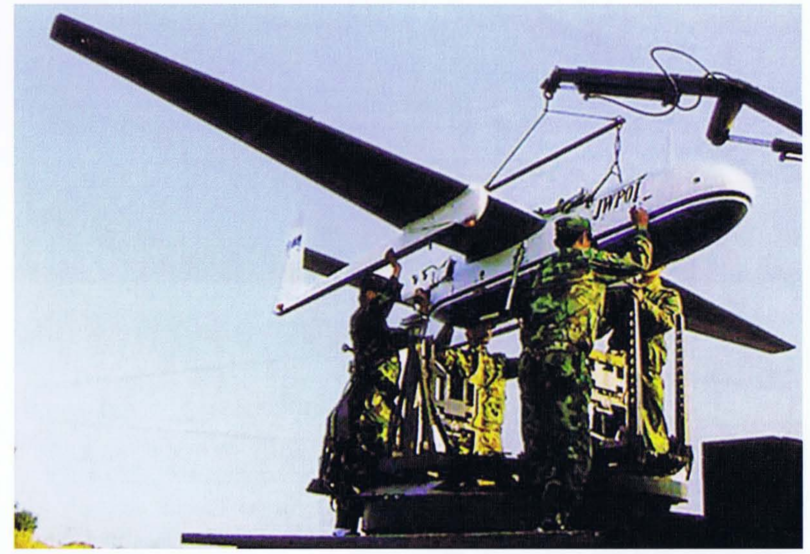
The mission equipment installed in the nose is interchangeable. In intelligence, surveillance and reconnaissance (ISR) configuration the ASN-206 carries a gyrostabilised multi-mission optronic turret, which has a modular design with different combinations of sensors. The turret is 548 mm ($21\frac{37}{64}$ in) high, with a diameter of 354 mm ($13\frac{15}{16}$ in), and rotates to give a 360° field of view, elevating through +15°/–105°. The equipment installed in it may be monochrome and colour charge-coupled device (CCD) cameras, or three colour CCD cameras, or infrared cameras working in a waveband of 8-12 micrometers, or a laser rangefinder/target designator.



An ASN-206 on its launcher vehicle. Note the shaft at the rear used for cranking up the engine.

For the electronic warfare and countermeasures roles the UAV can be fitted with a JN-1102 EW/ECM suite, which can scan, intercept, analyse, monitor, and jam enemy ground-to-air communications at 20-500 MHz. The system consists of a intercept subsystem, a jamming subsystem (both of them airborne) and a ground-based intercept and jamming control subsystem.

Apart from the UAVs (of which there are six to ten), the system includes a transporter/launcher, a communications/data processing unit, a maintenance/test vehicle (all based on separate cross-country lorries) and a radio relay van based on a minibus.



An ASN-206 is placed onto the launcher by a hydraulic crane.

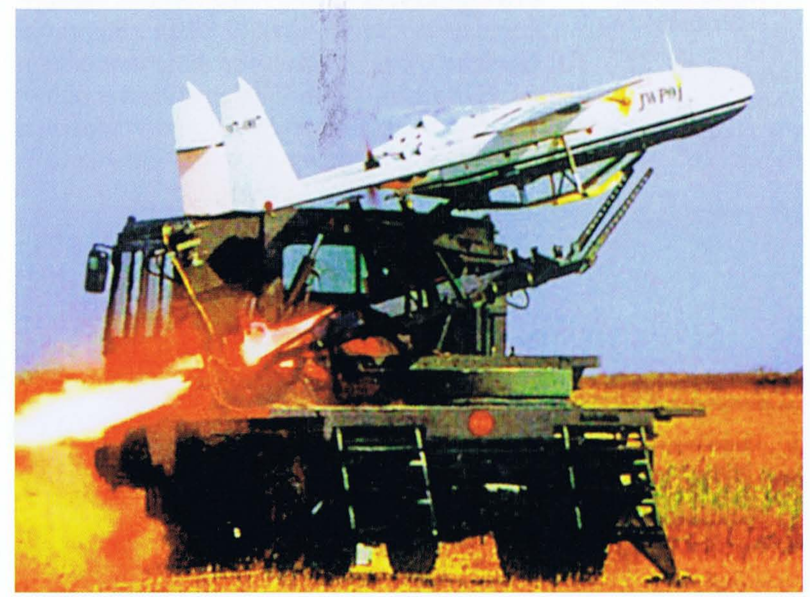
A field scene with the mobile control and data processing stations associated with the ASN-206 waiting for the UAV to launch.

The ASN-206 is 3.8 m (12 ft $5\frac{39}{64}$ in) long and likewise 1.4 m high, with a wing span of 6 m (19 ft $8\frac{7}{32}$ in). The launch weight is 222 kg (489 lb) and the mission payload is 50 kg (110 lb). The UAV has a service ceiling of 6,000 m (19,685 ft), a top speed of 210 km/h (130.5 mph) and a combat radius of 150 km at 2,000 m (6,560 ft); the endurance varies from 4 to 8 hours.

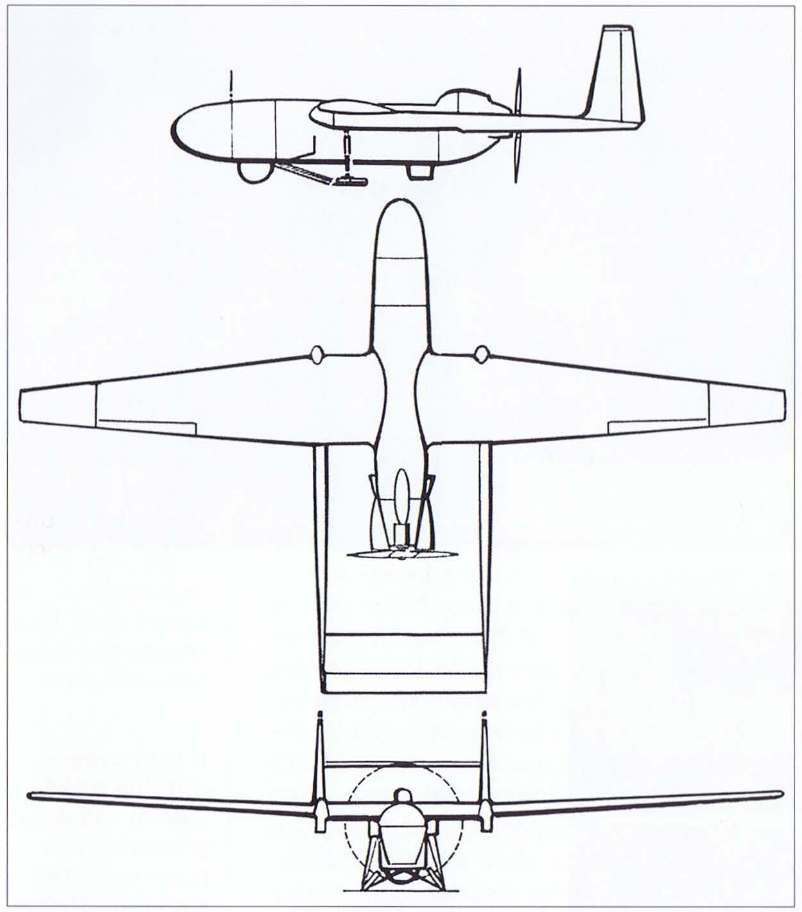
ASN-207 reconnaissance system

The ASN-207 theatre-tactical reconnaissance system is intended for conducting reconnaissance within a depth of up to 600 km (372 miles) behind enemy lines. Hence it comprises two types of UAVs sharing the same airframe – the actual reconnaissance aircraft and a communications relay aircraft transmitting the intelligence from the first UAV to the ground control station via data link. Both types are powered by piston engines and launched from a catapult by means of rocket boosters, making a horizontal landing at the end of the mission. The UAVs feature a navigation suite combining an inertial navigation system, a GPS receiver and an air data system. The reconnaissance UAV is fitted with a gyrostabilised optronic mission platform mounting a digital video camera, an IR linescan system and a laser rangefinder/target designator. The aircraft also carries a forward-looking IR sensor, ELINT equipment, a radar warning receiver and an ECM system.

The reconnaissance system further includes a ground control station, a ground data link station (with auxiliary remote data relay trans-



ASN-206 '97-007' is caught by the camera as the booster fires, catapulting the UAV into the air.



A three-view of the ASN-206.

ceivers), a pre-flight check and maintenance unit and a data processing unit working in conjunction with the control station. All four are based on lorries.

The UAVs are 6 m (19 ft 8 7/32 in) long and 2.1 m (6 ft 10 5/8 in) high, with a wing span of 9.3 m (30 ft 6 9/64 in). The empty weight is 250 kg (551 lb), the launch weight being 480 kg (1,058 lb) for the reconnaissance version and 410 kg (903 lb) for the relay version; the mission payload is 100 kg (220 lb) and 30 kg (66 lb) respectively. The two versions have a service ceiling of 6,000 m (19,685 ft) and 8,000 m (26,250 ft) respectively and a top speed of 180 km/h (111 mph); their combat radius is 600 km (372 miles) and 200 km (124 miles). The endurance is 16 hours.

The ASN-206 on display at one of the Zhuhai airshows.

ASN-209 reconnaissance UAV

A compact reconnaissance UAV designated ASN-209 has been developed. It has the same twin-boom pusher layout and uses the same catapult launch/parachute recovery principle as the ASN-206 but is slightly smaller and has a circular-section fuselage No performance details are available as of this writing.

TJ-1 target drone

Motivated by the US military's use of cruise missiles in many recent conflicts, China sought to develop means of training its air defence forces in neutralising this type of threat. The TianJian-1 (or simply TJ-1) target drone is one of the latest designs emulating cruise missiles. It is a compact high-wing design with conventional tail surfaces and a small turbojet housed in a nacelle under the rear fuselage. The TJ-1 is launched from a ground ramp by means of a solid-fuel rocket booster and controlled by radio from a ground control station; it can also fly in autonomous mode, using GPS navigation. The drone has a parachute recovery system and shock-absorbing airbags.

The drone is 3.0 m (9 ft 10 7/64 in) long, with a wing span of 1.5 m (4 ft 11 in), and has a maximum launch weight of 80 kg (176 lb). The maximum speed is 720 km/h (447 mph), the service ceiling is 4,000 m (13,120 ft), the endurance is 30 minutes and the maximum remote control range is 50 km (31 miles).

The TJ-1 entered PLA service in early 2005 and was unveiled to the public during the 2005 China International Defence Electronics Exhibition (CIDEX) held in Beijing in April 2005.

CK-2 drone

It is known that a supersonic successor to the CK-1 designated CK-2 (Chang Kong-2) has been developed. No detailed information on the CK-2 is available, but it is understood that the vehicle first flew in the early 1990s, and its first successful supersonic flight took place in early 1995.

Guizhou WZ-9 reconnaissance UAV

In 1999 the Guizhou Aviation Industry Group (GAIG) began development of a compact reconnaissance UAV designated WZ-9. The machine had a plump fuselage; the mid-set wings of low aspect ratio were placed well aft. Two small jet engines were located side by side on top of the rear fuselage, breathing through a split intake and exhausting between the halves of a butterfly tail; this was supposed to reduce the radar and IR signatures.

Some sources say the WZ-9 was later redesignated WZ-2000 but this doesn't ring true, as the WZ-2000 is a rather different UAV – see next entry.

Guizhou WZ-2000 reconnaissance UAV

At Airshow China 2002 GAIG unveiled the WZ-2000 high-altitude reconnaissance UAV. A more accurate model of the UAV was displayed at Zhuhai two years later.

Again, the WZ-2000 incorporates some 'stealth' features; for example, the low-set gently swept high aspect ratio wings are blended seamlessly with the flat fuselage underside. The vehicle has a butterfly tail with an angle of approximately 40° between the tails. The powerplant is a single WS-11 turbofan buried in the rear fuselage and breathing through a dorsal intake with an S-duct; the nozzle is positioned between the tails to reduce the radar and IR signatures.

The mission equipment includes electro-optical sensors and possibly a synthetic aperture radar. The intelligence gathered is relayed to the ground in real time via a satcom system whose transmitter antenna is located in the grossly bulged fuselage nose.

The WZ-2000 made its first flight on 26th December 2003. The onboard remote sensing system was successfully tested in August 2004. An upgraded version of the UAV designated WZ-2000B is also said to be under development.

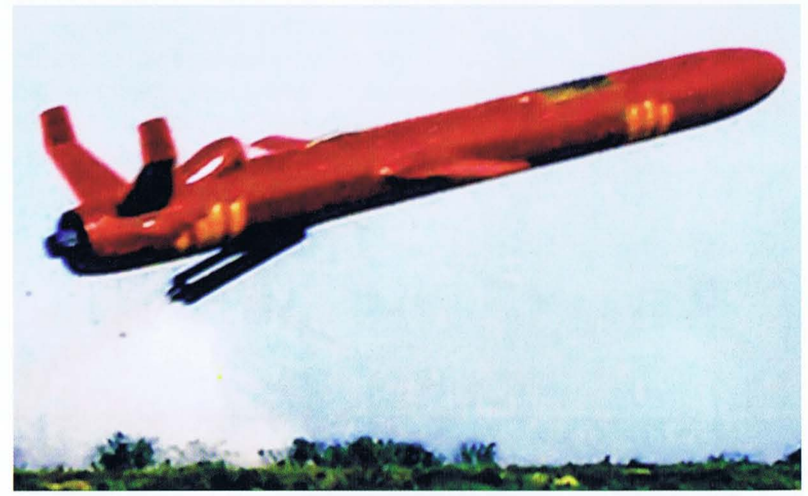
The vehicle is 7.5 m (24 ft 7 9/32 in) long, with a wing span of 9.8 m (32 ft 1 53/64 in); the maximum launch weight is 1,700 kg (3,750 lb), including a mission payload of 80 kg (176 lb). The WZ-2000 has a maximum speed of 800 km/h (496 mph), a service ceiling of 18,000 m (59,055 ft), a combat radius of 800 km (496 miles) and an endurance of 3 hours.

The ASN-209 reconnaissance UAV at an exhibition.

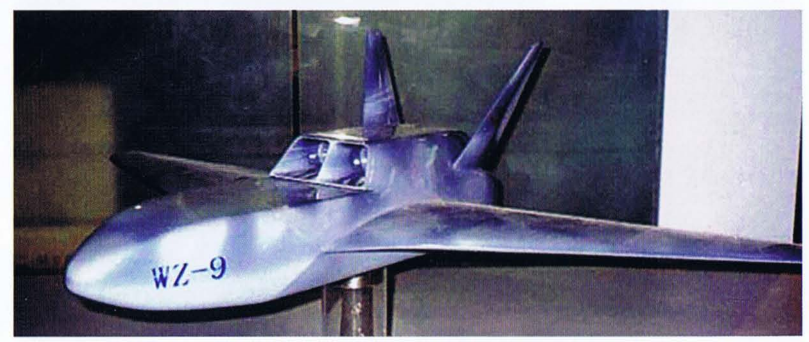
Shenyang Anjian UCAV

At Airshow China 2006 in Zhuhai the Shenyang Aircraft Corporation acting as part of the AVIC I consortium surprised everyone by unveiling a model of an unmanned combat aerial vehicle (UCAV) named Anjian (Dark Sword). The unconventional-looking machine had a blended wing/body design and a tail-first layout, with a delta-shaped fuselage, trapezoidal wings of low aspect ratio, small triangular all-movable canard foreplanes and twin trapezoidal fins canted strongly outwards and augmented by twin ventral fins. The single engine breathed through a chin intake located in line with the canards.

The accompanying placard stated the Anjian was intended for counter-air combat missions (!). The AVIC I representatives at the



A TJ-1 target drone is catapulted from a launch ramp. Note the dorsal intake of the cruise engine.



A model of the projected WZ-9 reconnaissance UAV. The engine exhausts are screened by the fins for added stealth.

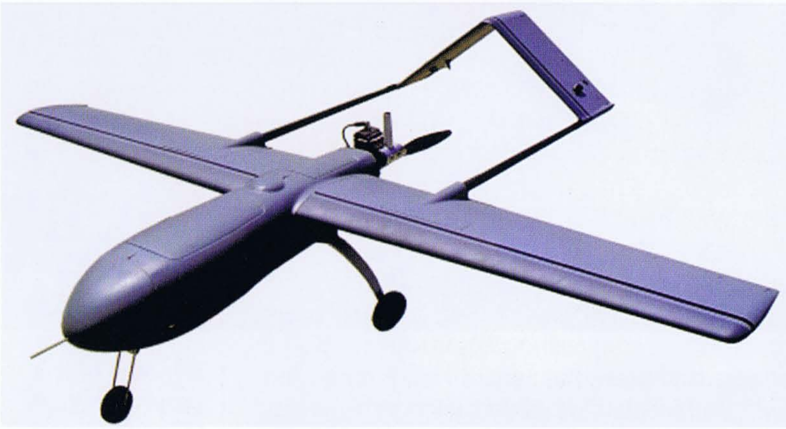
A model of the WZ-2000 high-altitude reconnaissance UAV.

show were very close-mouthed about the UCAV, declining to reveal any details. This made the vehicle highly controversial; some aviation industry experts questioned the ventral location and size of the air intake, which were at odds with the apparent efforts made to reduce the aircraft's radar signature, and the sharply cut-off rear fuselage which would generate considerable drag. Also, the purported counter-air role was called into question, since generally aircraft designers attach higher priority to unmanned bombers when developing UCAVs, unmanned fighters being regarded as a thing of the more distant future. Hence some were wont to regard the model as a 'red herring'. It has been suggested, however, that the Anjian could in reality represent a long-range hypersonic strike UCAV concept and that the large air intake suggested a ramjet engine, which would be consistent with this role.

Chengdu Xianglong reconnaissance UAV

Another new UAV unveiled in model form at Airshow China 2006 was the Xianglong (Soar Dragon) long-range high-altitude reconnaissance UAV presented by the Chengdu Aircraft Corporation. The vehicle looked like a direct copy of the US Air Force's RQ-4 Global Hawk, featuring a fuselage with a bulged 'head', low-set high aspect ratio unswept wings and a single turbofan mounted atop the rear fuselage to exhaust between the halves of the butterfly tail. The model implied that the vehicle was smaller and lighter than the RQ-4, judging by the main landing gear units which had single wheels instead of the American UAV's twin wheels.

An accompanying placard stated the Xianglong is to be 12.3 m (40 ft $4\frac{1}{4}$ in) long and 5.4 m (17 ft $8\frac{39}{64}$ in) high, with a wing span of 25 m (82 ft $0\frac{1}{4}$ in). The normal take-off weight is to be 7,500 kg (16,530 lb), including a 650-kg (1,430-lb) mission payload; the cruising speed is to be 750 km/h (466 mph), the cruising altitude 18,000 m (59,055 ft) and the range 7,000 km (4,350 miles).



A computer-generated image of the Hua Ying reconnaissance UAV.

A model of the Xianglong UAV at Airshow China 2006. The vehicle looks like a scaled-down RQ-4 Global Hawk!

BUAA Haiou reconnaissance VTUAV

The Beijing University of Aeronautics and Astronautics (BUAA) has been developing a vertical take-off and landing UAV (VTUAV) – a remotely piloted helicopter called Haiou (Seagull). The machine bears a certain resemblance to the Kamov Ka-37 VTUAV, featuring two-bladed contra-rotating rotors and a twin-fin tail unit. The nose of the plump fuselage incorporates a large window for electro-optical sensors; the VTUAV has a skid landing gear. The Haiou's VTOL ability allows it to operate from the decks of surface ships – or even submarines which surface to reconnoitre (in the manner of some German and Japanese World War Two subs which were to carry their own reconnaissance aircraft).

Hua Ying reconnaissance UAV

A reconnaissance UAV known as Hua Ying ('Chinese Eagle') is known to be in service with the PLA. Among other things, it was used for damage assessment in the wake of the force 8 earthquake that hit Sichuan Province on 12th May 2008, flattening towns and killing close to 70,000. The UAV has an autopilot and GPS-guided navigation. Flight endurance is three hours.

A model of an obscure stealthy UAV combining canards with a butterfly tail.

Unidentified UAVs

Several other Chinese UAVs on which no information is available are known to exist. One of them, a tactical UAV, has a highly unusual appearance, utilising a blended wing/body layout with mid-set cropped-delta wings and high-set cropped-delta canard foreplanes (featuring inset elevators) in addition to a butterfly tail. The powerplant is a piston engine at the aft extremity of the fuselage driving a pusher propeller.

Two other tactical UAVs closely related to each other utilise a pod-and-boom layout. In both cases a horizontally opposed piston engine with a pusher propeller is mounted at the rear of the pod above a slender low-mounted tailboom carrying a butterfly tail. Both UAVs have cranked wings with dihedral outer sections, but in one case the wings are mid-set and a wide-track tailwheel landing gear, while the other one is a high-wing aircraft with a tricycle landing gear.

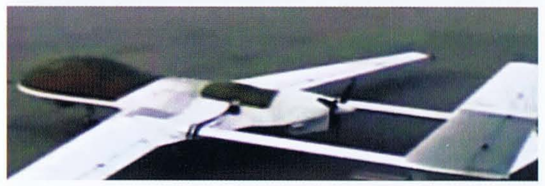
The tubby BUAA Haiou surveillance VTUAV uses the co-axial layout.

Several unidentifiable UAVs were seen at a Chinese trade fair, including this tilt-rotor VTUAV.

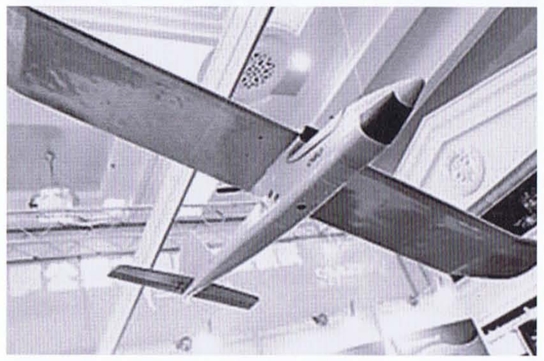
This UAV by Up-Tech has an unusual wheel/skid landing gear.

The very similar Airmice UAV with a four-wheel landing gear.

A catapult-launched UAV and a single-rotor VTUAV.



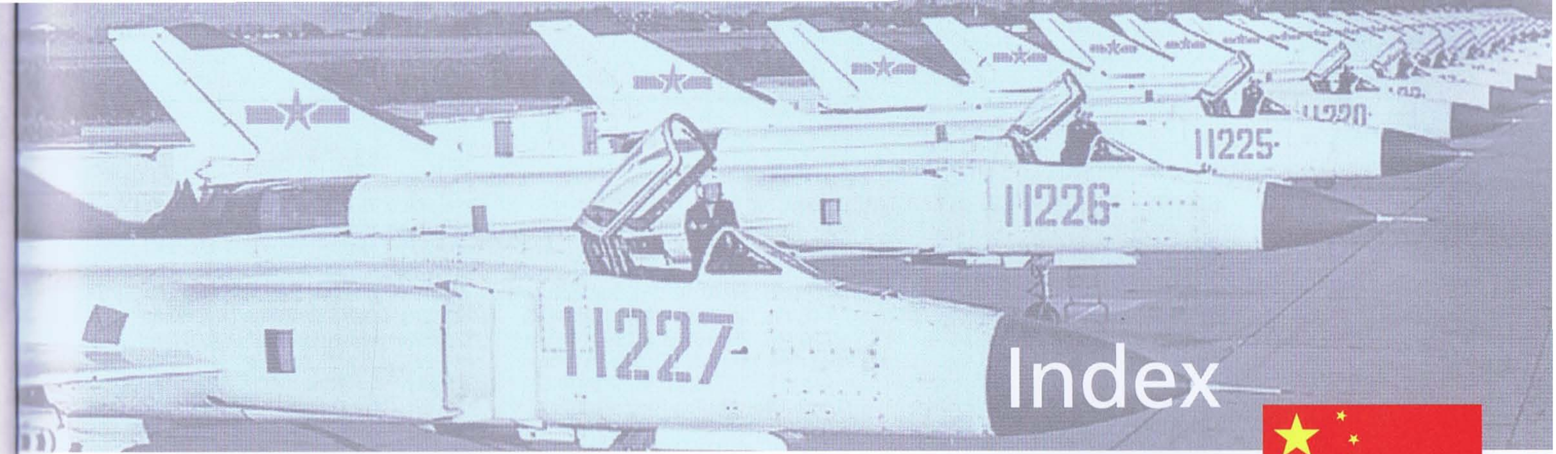
A jet-powered stealthy UCAV and one more twin-boom tactical UAV.



A man-portable UAV with a pusher powerplant above the wings.

Another unidentified UAV featuring tandem wings.

A model of the highly controversial Anjian (Dark Sword) UCAV.



Index

AIRCRAFT TYPES – CHINESE

Index by designation (or name) of Chinese indigenous aircraft.

Chinese production, conversions or adaptations of overseas types covered in the main text of this book:

AIRCRAFT TYPES – NON-CHINESE

AIRLINES

COUNTRIES/AIR FORCES

ENGINES

NATO REPORTING NAMES

RADARS

WEAPONS

When communist China and the Soviet Union were on friendly terms in the 1950's, the Soviet Union assisted in the setting up of the Peoples Liberation Army Air Force (PLAAF) by delivering combat aircraft and training Chinese personnel.

However, since Soviet deliveries could not satisfy the growing demands of the Chinese war machine and civil air transport, the Beijing government perceived the need to set up an indigenous aircraft industry. Established in 1950 with Soviet assistance, it began with the repair and refurbishment of aircraft during the Korean War but soon moved on to production of aircraft under Soviet licence.

Following the 1960s rift between Moscow and Beijing on ideological grounds, China found itself in a predicament; no aircraft deliveries could be obtained from the former ally, to say nothing of the Western world. Thus the national aircraft industry had to resort to reverse-engineering Soviet types and adapting them to local needs. As the Chinese aircraft industry gained experience, versions of Soviet aircraft having no equivalents on the wrong side of the Great Wall started appearing, as did wholly indigenous designs. Later, as China's relations with the Western world improved, licence production of American and French aircraft types started taking place.

Now, for the first time, *Chinese Aircraft* records the industry's developments and achievements and provides a complete list of all aircraft produced presenting a unique insight into this previously unknown world.

Price UK £34.95 USA $59.95

ISBN 978-1-9021090-4-6

HIKOKI PUBLICATIONS

www.crecy.co.uk